Socio-economic Impact of Mining on Rural Communities: A Study of the Ib Valley Coalfield in Odisha

Thesis submitted in partial fulfilment of the requirements for the degree of

Doctor of Philosophy

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This is to certify that the thesis entitled "**Socio-economic Impact of Coal Mining on Rural Communities: A Study of the IB Valley Coalfield in Odisha**" being submitted by Ms. Nabanita Das, Roll No. 509HS304, to the National Institute of Technology, Rourkela, India, for the award of the degree of **Doctor of Philosophy** is a record of confide research carried out by her under my supervision.

The Candidate has fulfilled all the prescribed requirements.

The thesis is based on candidate's own work, has not been submitted elsewhere for the award of any degree to the best of my knowledge and belief.

In my opinion, the thesis is of the standard required for the award of Doctor of Philosophy in Sociology.

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Abstract

Natural resources are an integral part of all human civilization. Again, natural resources that can either be renewable or non-renewable, affords adequate atmosphere towards economic development. Coal as a form of non-renewable natural resource is obtainable through excavation. But in the process, it is often regarded as a socially and environmentally stubborn substance. In India, the process of globalization has encouraged the industrial giants to mine the natural resources which have witnessed a virtuous symbol of economic activity since then. By introducing this resource-extraction industry, the unindustrialised realms are earning substantial section of foreign exchange and at the same time subsidising obviously to the growth of gross domestic product. At the onset, the new mining projects necessitated massive acres of land to execute their operation and started convincing the mass by providing a better income earning environment as well as the infrastructural developments like well-connected roads, electricity, health care facilities etc. But the fruit of development cannot be fortified by overlooking the source and means of living of the project affected communities. Moreover, the by-products of coal mining such as loss of agro-based livelihood, decrease of natural capital, pollution and ill health are becoming the matter of concern globally. In this background the present study was undertaken by taking three specific objectives: first, to analyse the impact of coal mining on the local communities and their livelihood with special reference to Ib Valley coalfield; second, to explore the impact of coal mining on the rural social structure; and finally, to assess the adverse effects of coal mining on the health condition of rural people. To attain these objectives, the present research was carried out in the Ib Valley Coalfield, a subsidiary of Mahanadi Coalfields Limited. Much before the instigation of field work a pilot study was conducted and on the basis of that pilot study, six mining affected villages and two control villages were selected in the same district and within the same agro-climatic zone. While mining affected villages were selected within the vicinity of three kilometres from mining, control villages were selected around twenty kilometres distance from the active mining region. Using the systematic random sampling method, a sample of 50 households from each village was undertaken. Thus a total of 400 such households (300 from mining affected villages and 100 from control villages) were taken as sample for the study. Data were collected by

employing both qualitative and quantitative techniques. Primary data were collected using household schedule, case study, observation methods and some unstructured questionnaires. Discussions were organized with public and other stakeholders. In depth interview was also held with officials from the Mahanadi Coalfields Limited, State Government, NGO personnel, and local leaders. For secondary information, government records, newspaper articles and other available literatures were reviewed. Then the data were analysed by using SPSS software. The findings of the research conclude that mining has given rise to positive implications on financial capital and can be held responsible for mixed impacts on human and physical capital. In one aspect, it is providing a wider atmosphere for diversified sources of livelihood generation; on the other aspect it has alienated the project affected rural communities from their traditional agro-based livelihoods. Subsequently, with the introduction of mining projects, the network ties among the mining affected mass is getting disturbed and the traditional base of structural aspect has lost its significance. Results also indicate that along with improved infrastructure, it has ironically created conducive condition for pollution of air, water and noise that in turn are responsible for varied health issues. Though the provision of medical assistance is available, it is only restricted to the workforce of MCL and others are not fortunate enough to avail any benefit.

Key Words: Livelihood, Ib Valley, agriculture, social structure, health

CONTENTS

Certificate
Acknowledgement
List of Abbreviations
List of Tables
List of Figures

Chapter-1 **Page No.**
Background, Objectives and Methodology of the Study **1-35**

1.1. Introduction
1.2. Mining, Local Communities & Livelihood
1.3. Mining, Environment & Health
1.4. Mining and Socio-economic Aspects
1.5. Mining & Gender
1.6. Statement of the Problem
1.7. Research Questions
1.8. Specific Objectives of the Study
1.9. Conceptual Framework of the Study
    1.9.1. Theory of Alienation
    1.9.2. Ruthenberg'sRotation Values
    1.9.3. The Strength of Weak Ties
    1.9.4. Social Solidarity
    1.9.5. DFID's Livelihood Framework
1.10. Methodology
    1.10.1. Universe of the Study
    1.10.2. Rationale behind the selection of Study Area
    1.10.3. Sampling Procedure
    1.10.4. Systematic Sampling
    1.10.5. Extensive Fieldwork and Rapport with the Villagers
1.11. Sources of Data
    1.11.1. Primary Data Collection
        1.11.1.1. Observation
        1.11.1.2. Interview
        1.11.1.3. Case Study
        1.11.1.4. Schedule
        1.11.1.5. Focused Group Discussion
1.12. Secondary Data Collection
1.13. Methods of Data Analysis
1.14. Thesis Structure

Chapter-II
Mining Scenario in India **36-63**
2.1. Mining Scenario in India
2.2. Coal Mining in India: The Past
2.3. Nationalisation of Coal Mines
2.4. Formation of Coal Companies
2.5. Coal Reserve in India
2.6. State wise Share of Coal Reserve
2.7. Production of Coal by Grades & Sectors
2.8. Production from Underground & Opencast Mines
2.9. Productivity of Coal (OMS)
2.10. Despatch & Offtake of Coal
2.11. Manpower of CIL
2.12. Import of Coal
2.13. Mining in Odisha
    2.13.1. History of Mining in Odisha
    2.13.2. Mineral Reserve in Odisha
    2.13.3. Coal Mining in Odisha
    2.13.4. Production of Coal by MCL
    2.13.5.. Productivity of Coal by MCL
    2.13.6. Consumers of MCL
    2.13.7. Manpower of MCL
    2.13.8. IB Valley Coalfield
    2.13.9. Operating Areas of IB Valley Coalfield
Chapter-III
Socio-economic Profile of the Study Area **64-79**
3.1. Location of the Sample Villages
3.2. Basic Infrastructure
3.3. Land Acquisition
3.4. Land Holding
3.5. Household Pattern
3.6. Classification of Household
3.7. Demographic Profile of the Sample Households
3.8. Age & Gender
3.9. Occupation
3.10. Education
3.11. Particulars & Distance
3.12. Ethnic Composition
3.13. Social Organisation
    3.13.1. Marriage System
    3.13.2. Family
3.14. Language & Communication
3.15. Political Organisation
3.16. Economic Organisation

3.17. Culture & Religion

Chapter-IV
Impact of Mining on Rural Social Structure **80-124**
4.1. Introduction
4.2. Mining & Social Aspects: An Overview
4.3. Impact of Mining on Family Structure
4.4. Impact of Mining on the Functions of Family
    4.4.1. Impact of Mining on Old Age Population
    4.4.2. Impact of Mining on Status & Position of Women Folk
4.5. Impact of mining on Kinship System
4.6. Impact of mining on Functions of Marriage
4.7. Impact of Mining on Marriage Pattern
    4.7.1. Caste Endogamy
    4.7.2. Clan Exogamy
4.8. Impact of Mining on Dowry System
4.9. Impact of mining on Caste System
4.10. Impact of Mining on Traditional Power Structure
4.11. Mining & the Changing Scenario of *Jajmani* System
    4.11.1. Change in Landlord-*Purohit* Relationships
    4.11.2. Change in Landlord-Service *Jati* Relationships
    4.11.3. Change in Landlord-Agricultural Labour Relationships
4.12. Impact of Mining on Fairs & Festivals
    4.12.1. Impact on Community Level Festivals
    4.12.2. Impact on Household Level Festivals
4.13. Impact of Mining on Community Life & Social Security
4.14. Shift of Social Solidarity & Transformed Social Structure
4.15. The Weak Ties of Social Structure
4.16. Conclusion

Chapter-V
Mining and Rural Livelihoods **125-165**
5.1. Introduction
5.2. The Archives of Sustainable Rural Livelihood (SL)
5.3. Execution of SL Approach by Donor Agencies
5.4. Sustainable Livelihoods Approach by DFID
5.5. Mining & Rural Livelihoods
    5.5.1. Vulnerability & Diversified Rural Livelihoods
5.6. Mining & Livelihood Assets
    5.6.1. Impact on Human Capital
        5.6.1.1. Health & Health Care Facility
        5.6.1.2. Education
        5.6.1.3. Skills & Knowledge
    5.6.2. Impact on Physical Capital

5.6.2.1. Community Level Physical Capital
5.6.2.2. Household Level Physical Capital
5.6.3. Impact on Financial Capital
5.6.3.1. Annual Expenditure
5.6.4. Impact on Natural Capital
5.6.4.1. Impact on Natural Environment
5.6.4.2. Impact on Natural Vegetation
5.6.5. Impact on Social Capital
5.6.5.1. Resettlement Status
5.7. Impact of Mining on Women's Livelihood
5.8. Policies, Institutions & Mining
5.9. Livelihood Outcomes

Chapter-VI
Mining & Agriculture **166-182**
6.1. Introduction
6.2. Impact of Mining on Agriculture: An Overview
6.3. Impact of Mining on Agriculture at IB Valley
6.3.1. Cropping Pattern of IB Valley
6.3.2 Agricultural Scenario in Ib Valley
6.3.3. Cropping Intensity
6.4. Input and Output of Production
6.4.1. Cultivated Area and Crop Production
6.4.2 Seeds
6.4.3. Fertilizers
6.4.4. Pesticides
6.4.5. Means of Production
6.4.6. Labour Pattern
6.5. Alteration in Agricultural Production
6.6. Conclusion

Chapter-VII
Mining and its Impact on Health **183-215**
7.1. Introduction
7.2. Reasons behind Vulnerable Health
7.2.1. Air Pollution
7.2.2. Water Pollution
7.2.3. Noise Pollution
7.3. Frequency and Occurrences of Health Harms
7.4. The Socio-Economic Cost of Health Hazards
7.4.1. Health Effects
7.4.2. Cost of Health Hazards
7.4.3. Indirect Cost of Health Hazards
7.5. Total Cost of Health Hazards
7.6. Impact of Mining on the Health of Livestock
7.6.1. Expenditure on Livestock
7.7. Conclusion

Chapter-VIII
Summary and Conclusions **216-233**
8.1. Methodology
8.2. Overall Findings
8.2.1. Impact on Rural Social Structure
8.2.1.1. Structure of the Family
8.2.1.2. Functions of Family
8.2.1.3. Marriage
8.2.1.4. Caste System
8.2.1.5. Mining and Power Structure
8.2.1.6. Mining and the Rise of Contractor Class
8.2.1.7. Mining and *Jajmani* Transformations
8.2.1.8. Mining, Fairs and Festivals
8.2.1.9. Mining and Community Life
8.3. Impact on Livelihood
8.4. Impact on Agriculture
8.5. Impact on Health
8.6. Conclusion
8.7. Recommendations
8.8. Implication of the Study
8.9. Scope for the Future Research

References **234-252**
Appendix

ABBREVIATION

AMD : Acid Mine Drainage

APL : Above Poverty Line

B.C. : Before Christ

BCCL: Bharat Coking Coal Limited

BOCM: Belpahar Opencast Mines

BP : Blood Pressure

BPL : Below Poverty Line

Ca : Calcium

CBA : Coal Bearing Area

CCL : Central Coalfields Limited

Cd : Cadmium

CDC : Centre for Disease Control and Prevention

CHC : Community Health Centre

CIL : Coal India Limited

CMAL: Coal Mines Authority Limited

CMO : Chief Medical Officer

CMPDIL: Central Mine Planning and Designing Limited

CO_2 : Carbon Dioxide

COPD: Chronic Obstructive Pulmonary Disease

CPR : Common Property Resources

CSE : Centre for Science and Environment

CSR : Corporate Social Responsibility

Cu : Cupper

DFID : Department for International Development

DVC : Damodar Valley Corporation

EC : Electrical Conductivity

ESO : Economic Survey of Odisha

Fe : Iron

FGD : Focused Group Discussion

GC : General Category

GDP : Gross Domestic Product

GSDP: Gross State Domestic Product

HBI : Hirakhand Bundia Incline

HLS : Household Livelihood Security

HRC : Himgir-Rampur Colliery

IBM : Indian Bureau of Mines

IDS : Institute of Development Studies

IISCO: Indian Iron and Steel Company Limited

KG : Kilogram

KM : Kilometre

LOCP: Lakhanpur Opencast Project

MCL : Mahanadi Coalfields Limited

MECL : Mineral Exploration Corporation Limited

MFP : Minor Forest Product

Mn : Manganese

MOC : Ministry of Coal

MOEF: Ministry of Environment and Forest

MT : Million Tonne

NAAQS: National Ambient Air Quality Standard

NCDC: National Coal Development Corporation

NCL : Northern Coalfields Limited

NEC : North Eastern Coalfields

NH : National Highway

Ni : Nickel

NO_x : Nitrogen Oxide

OAS : Odisha Agricultural Statistics

OBC : Other Backward Caste

OCP : Opencast Project

OECD : Organisation for Economic Corporation and Development

OMS : Output per Man Shift

Pb : Lead

pH : Measure of Acidic Water

R&R : Resettlement and Rehabilitation

SC : Schedule Caste

SCCL: Singareni Collieries Company Limited

SD : Standard Deviation

SECL : South Eastern Coalfields Limited

SHD : Sustainable Human Development

SL : Sustainable Livelihood

SO_2 : Sulphur Dioxide

SOCP: Samaleswari Opencast Project

SPM : Suspended Particulate Matter

ST : Schedule Tribe

TB : Tuberculosis

TDS : Total Dissolved Solids

TERI : The Energy and Resources Institute

TISCO: Tata Iron and Steel Company Limited

TPM : Total Particulate Matter

TRL : Tata Refractories Limited

TSP : Total Suspended Particulate Matter

WCED : World Commission on Environment and Development

WCL : Western Coalfields Limited

WHO : World Health Organisation

Zn : Zinc

List of Tables

Table No.	Title	Page No.
Chapter-II		
Table No. 2.1	Number of Reporting Mines in India	37
Table No. 2.2	CIL's Subsidiaries	40
Table No. 2.3	Categorization of Coal resources in India	41
Table No. 2.4	Status of Coal in Gondwana Coalfields	41
Table No. 2.5	Status of Coal in Tertiary Coalfields	42
Table No. 2.6	Production of Coal during 1951-2015	44-45
Table No. 2.7	Subsidiary wise Coal Production	46
Table No. 2.8	Sector wise Production of Coal in India	46
Table No. 2.9	Company wise Production of Coal (Apr-Mar, 2014-15)	47
Table No. 2.10	Productivity: Output per Man Shift (Oms)	48
Table No. 2.11	Despatch & Offtake of Raw Coal in India (2013-14)	49
Table No. 2.12	Despatch & Offtake of Washed Coal in India (2013-14)	49
Table No. 2.13	Sector wise Despatch of Coal, 2012-13 & 2013-14	50
Table No. 2.14	Man Power of CIL & its Subsidiaries	51
Table No. 2.15	Import of Coal	51
Table No. 2.16	Mineral Reserves in Odisha	54
Table No. 2.17	Sector wise Offtake of Coal	58
Table No. 2.18	Manpower of MCL	58
Table No. 2.19	Mining Details of IB valley Coalfield	62
Chapter-III		
Table No. 3.1	Distance of Sample villages from Mining	64
Table No. 3.2	Basic Infrastructure & Access to Common Property Resources	65-66
Table No 3.3	Area wise Land Acquisition, Possession and Balance(As on 31/03/2014)	68
Table No 3.4	Magnitude of Land Holders	69
Table No. 3.5	Household Patterns	70
Table No. 3.6	BPL & APL Households	71
Table No. 3.7	Demographic Details of the Sample Villages	71
Table No. 3.8	Age & Gender of the Household Heads	72
Table No. 3.9	Occupation of the Sample Households	73
Table No. 3.10	Caste Wise Educational Qualification	74
Table No. 3.11	Particulars and Distance	75-76
Table No. 3.12	Marital Status of the Household Head	77
Chapter-IV		
Table No. 4.1	Type of Family Structure	88
Table No. 4.2	Family Support for Outside Work of Women	95
Table No. 4.3	Respondents Response on Functions of Marriage	98

Table No. 4.4	Patterns of Marriage	100
Table No. 4.5	Caste Endogamy and Preference of Marriage	102
Table No. 4.6	Clan Exogamy and Preference of Marriage	103
Table No. 4.7	Status of Dowry during Marriage	105
Table No. 4.8	Prevalence of *Jajmani* System	115-116
Table No. 4.9	Reasons behind the Non-observance of Festivals	118

Chapter-V

Table No. 5.1	Diversified Sources of Occupation	136
Table No. 5.2	Prevalent Diseases	140
Table No. 5.3	Land Distribution (Village Wise)	146
Table No. 5.4	Household Level Physical Assets	150
Table No. 5.5	Average Annual Income of the Households	152
Table No. 5.6	Annual Household Expenditure	154-155
Table No. 5.7	Primary Cooking Fuels	157
Table No. 5.8	Employment to land oustees provided by MCL Since inception (Figure of IB Valley Coalfield)	160
Table No. 5.9	Resettlement Status of IB Valley Coalfield	161

Chapter-VI

Table No. 6.1	Key Features of Agro-based Households	171
Table No. 6.2	Changes in Cropping Pattern	176
Table No. 6.3	Summary Statistics of Input and Output	180
Table No.6.4	Alteration in Agricultural Production	181

Chapter-VII

Table No. 7.1	Estimated Annual Health Impacts and Health Costs due to PM Pollution from the Coal-fired Power Plants in India (2011-12)	186
Table No. 7.2	Comparison of Trace Element Concentration In Ground Water of the Study Area with Indian Standard Drinking Water Specification	193
Table No. 7.3	Hospital wise Data on Diseases	198
Table No. 7.4	Frequency and Type of Health Problems	201
Table No. 7.5	Average Number of Days Un-well (Month)	205
Table No. 7.6	Direct Medical Cost (Monthly)	207
Table No. 7.7	Indirect Medical Cost (Monthly)	209
Table No. 7.8	Health Problems of Livestock	212
Table No. 7.9	Expenditure on Livestock (Monthly)	213-214

List of Figures

Figure No.	Title	Page No.
Chapter-I		
Figure 1.1	World Wide Production of Coal	4
Figure 1.2	Conceptual Framework	22
Chapter-II		
Figure 2.1	State Wise Share of Coal Reserve	42
Figure 2.2	Major Mineral Deposit in Odisha & its Share in India	54
Figure 2.3	Production of Coal by MCL	56
Figure 2.4	Operating Areas of Ib Valley Coal Fields	61
Chapter-V		
Figure 5.1	DFID's Sustainable Livelihoods Framework	131
Figure 5.2	Possession of Traditional Skills & Knowledge	144
Chapter-VII		
Figure7.1	Reasons behind Health Hazards	184
Figure 7.2 to 7.5	Air Pollution Scenario at Ib valley	188
Figure 7.6	People's Perception Regarding Air Pollution	189
Figure 7.7 to 7.10	Water Pollution Scenario at Ib valley	192
Figure 7.11 to 7.12	Blasting Scenario at Ib valley	195

List of Maps

Map No.	Title	Page No.
Chapter II		
Map 2.1	Coal Reserves in India	43
Map 2.2	Mineral Map of Odisha	53
Map 2.3	Map of Ib valley Coalfield	59

Chapter-I
Background, Objectives and Methodology of the Study

1.1. Introduction

Natural resources are an integral part of all human civilization. On earth, the intrinsic elements include fresh air, water, soil, plants, minerals and animals. Each of the resources ingests an identical substance for the endurance of all the human beings, animals and plants. Further, these resources are interrelated in such a way that life will be helpless without their existence. All the living creatures rely on natural resources for their continued existence, acceleration and expansion. Practically, all the civic activities are also interrelated and intermingled with natural resources. It delivers the base on which the entire network of development is reliant on. Starting from the usage of rudimentary well-being's to economic development, every strata has either direct or indirect interface on natural resources.

Natural resources can be considered as the fundamental base for the conservation of historical and cultural artefacts. While being the substance of economic activity and development, these resources are often undervalued and mismanaged (OECD, 2011a). This executes the disbursements of economic independency in a substantial manner. For a thrust to avail all kinds of modern amenities, the commercial populace is continuously exploiting the tranquillity of these resources. Besides the fresh air, water, soil and plants, in our routine lifecycle we are inherently involved with multiplicities of renewable and non-renewable natural resources.

On the basis of its ecological nature, natural resources are of two types i.e., renewable and non-renewable. Natural resources which can be substituted and recycled by nature almost in the identical proportion at which they are used are termed as renewable resources. Solar energy, wind or air, biomass, sunlight and living organisms like trees etc. can be cited as examples of renewable energy resources. On the other hand, non-renewable resources are those which are exhaustible and cannot be regenerated at a sufficient rate as per the consumers demand. These resources encompass fossil fuels such as coal, oil, natural gas, valuable ores, minerals and metals etc. (OECD, 2011b).

As discussed in the preamble of Ministry of Mines, minerals perpetuate substantial focus as they are non-renewable and inadequate in nature. But they are instrumental to deliver the raw materials starting from the peripheral development to global economic development. So the management of these natural resources is meticulously cohesive for the purpose of inclusive strategic development. Though India is a country of rich mineral resources, still it is not sanctified with all the indispensable mineral resources. Therefore a careful and scientific method is indispensable for its beneficiation and economic utilisation. At the same time, it is also imperative to preserve the mineral reserves for the fortification of present and future necessities of our country (MOM, 2008). Immediately after independence the mining sector of India, is proliferating an incredible growth both in terms of cost and magnitude. The country yields 87 minerals, which comprises 4 fuel, 10 metallic, 47 non-metallic, 3 atomic and 23 minor minerals (together with building and other materials). India holds the tag of world's prime manufacturer in mica mining, ranks 3rd in the production of coal, lignite and barytes, 4th in iron ore, 6th in bauxite and manganese ore, 10th in aluminium and 11th in crude steel in the world (MOM, 2013).

Among the non-metallic mineral reserves, coal holds a vital habitation in the branch of fossil fuel. Even, it fulfils around 55 percent of India's energy requirement (MOC, 2013). Besides India, coal has owned a substantial practice around the globe. Basically, the use of coal can be traced in the sectors of electricity generation, steel production, cement manufacturing and liquid fuel. Moreover, it is accountable for 30.1 percent of worldwide primary energy needs, 40 percent of global electricity and the major portion of it is responsible for the production of steel. Except these domains, it is also convenient to extract iron and additional metals from the ores. Moreover it has voluminous usages worldwide. Ever since 2000, the consumption of coal excelled the other fuels across the globe. This degree is confined mostly with the five largest coal using countries i.e. China, USA, India, Russia and Japan consuming 76 percent of total global coal use. Owing to its nature, coal has varieties of practises. Steam coal is predominantly helpful in power generation, coking coal is essential for the production of steel, merchant coke manufacturing and other metallurgical industries, and non-coking coal needed for in cement, fertilizer, glass, ceramics, paper, chemical and brick manufacturing and other heating purposes (BCCL, 2010; WCA, 2015a).

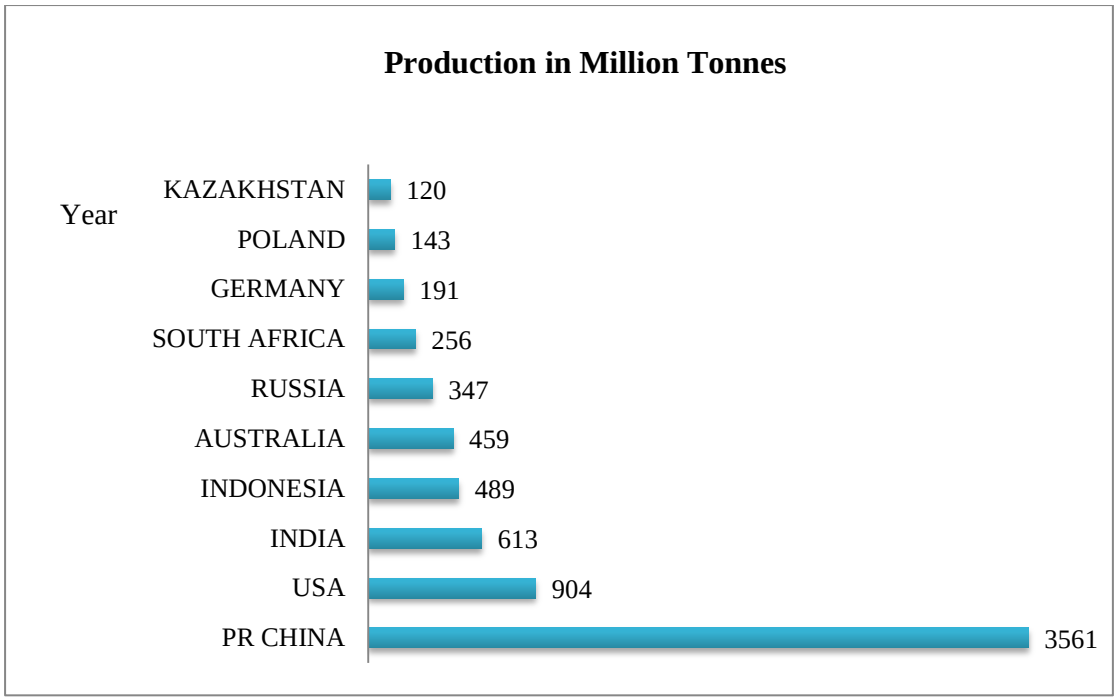
Coal has a substantial influence on the global economy. Asia, being the principal marketplace of coal is consuming 67 percent of global coal. Many countries across the globe are reliant on coal as they are not blessed with adequate energy resources to shelter their energy needs. Countries like Japan, Chinese Taipei and Korea, ingress substantial measures of stem coal which is meant for electricity generation and coking coal, needed for steel production. Even the alumina refineries, paper manufactures, chemical and pharmaceutical industries etc. are the regular consumers of coal. The evaluation on growing demand of energy resources shows that in between 2000 and 2010, coal encountered nearby half of global energy demand. Though, there occurred hurried exhaustion in case of renewable energy technologies, predominantly in the perspective of climate change, coal stand as the prominent unit of sustenance to fulfil the world-wide demand of energy. This became possible because of the constant, extensively scattered and reasonable nature of coal (WCA, 2015b).

Coal can be obtained through excavation which can be done either by underground or opencast, depending upon the geology of the coal deposit. Surface mining or opencast mining excavates larger fraction i.e. 90 percent of coal than that of underground mining. Usually, coal mining happens to occur in rural regions where the developmental activity like mining industries provides employment, if not, the majority of residents in the region. According to the recent estimation, coal industries are employing 7 million people worldwide and 90 percent belong to the developing countries. Coal mining, not only provides direct employment but also generates employment opportunities from its other associated units. Establishment of large scale coal mines are responsible for the substantial base of local revenues, at the same time it also provides incentives for the improvement of local infrastructure. In the process of coal extraction, mining industries are facing many oppositions regarding land use. But this problem can be resolved by appropriate counselling among the neighbouring residents, that mining is a temporary activity only and rehabilitation facilitates reclamation of the mined land for further obstinacies after mine closure (WCI, 2009a).

Coal resources are accessible around 70 countries across the globe. At current production level, proven coal reserves are estimated to last 112 years. Similarly, gas reserves and proven oil are corresponding around 45 and 46 years at existing production heights (WCA, 2015c). The global coal production in 2013 was 7823 million tonnes. Of them, top ten coal producing countries are China, USA, India,

Indonesia, Australia, Russia, South Africa, Germany, Poland and Kazakhstan. The details regarding the country wise production of coal is given in Figure No. 1.1.

Figure No. 1.1: World Wide Production of Coal



Source: http://www.worldcoal.org/resources/coal-statistics/

1.2. Mining, Local Communities & Livelihood

All the sources of energy including coal also have its numerous negative impacts. On the march of development the resource rich earth is being destroyed and the dependent of natural resources are becoming the victims (Sahoo, 2005). Whatever may be its form, it may be an opencast or underground, involves itself with widespread social, environmental and ecological complications such as pollution of air, water, noise and soil, deterioration of agricultural production, degradation of both physical and mental health, involuntary displacement, breakdown of community ties and social networks etc. Usually, opencast mines require larger amount of land and owing to its nature of extraction, it nurtures several socio-economic and environmental hazards (Singh, 2015).

From the perspective of the mining industries, their thrust is to robustly carry out their monopoly activities without having any attention towards the primitive dwellers of

the land. No doubt, mining take a step forward to empower the project affected communities by providing circumstances to avail employment opportunities, alleviated poverty, established new and planned connecting roads, school buildings etc. At the same time, mining also threatened the dominion of the indigenous communities (Mishra, 2012; Turton, 2009). As a result the local resources such as land, water, livelihood etc. are encountering varied faces of transformation (Bury & Jeffrey, 2002). So it is debatable, what happened with the indigenous communities, are they the beneficiaries or victims? By carrying out endless mining activities undoubtedly the country is becoming resource rich but at the same time it has brought displacement, modified their livelihood and also ignored the social and economic life of the indigenous communities (Velath, 2009).

Sometimes, coal extraction is leading to land use conflicts with the native inhabitants. Local residents used to oppose the establishment of mining industries owing to the fear of hindering their habitual pattern of livelihood. Usually, mining takes place in the mineral rich regions where, people are mostly dependent on nature and natural resources to sustain their livelihoods. But the modern commercial activities like coal mining industries are hampering their traditional way of life and also forcibly vacating their homestead lands. The assurance of reclamation and reuse of land, proper rehabilitation etc. remains in the pen and paper only. At the same time, the welfare measures serving directly to the governing fragments and others remain as victims without adequate manifestations of these so called development activities (Hilson, 2002; Andrew, 2003).

The growth of mining industries has contributed to the world's economic development including India. However, the mining industries are proving to be better investors by providing employment, both directly and indirectly, local infrastructural development and through foreign exchange earnings. Essentially, the establishment of mining industry necessitates the acquisition of fertile regions and on this march, they have been recognised as environmentally and socially stubborn substance (Melanie et al., 2007). In this regard, the impact of mining has been undertaken by varieties of researchers around the world.

Moreover, mining is a cost-effective industry in many developing countries. Activities that can be either small or large scale are intrinsically offensive to the society, while

producing mass scale displacement. Whereas, mining has its root in insensitive long term effects on the affected communities, it barely cares for their betterment. It has enormous juncture of deeds, each one of which has buried range of impact on the social networks, natural environment, cultural identity and traditional authority. Up to some degree, mining companies are trying to be better commune by adopting the resettlement and rehabilitation policies, under which the displaced communities are able to ascertain the remuneration on certain aspects like physical, job and monetary. But, if we look intently into the sustainable feature of improving human well-being, we could draw the conclusion of wasteful deterioration as a consequence of mining (Downing, 2002). Displacement not only engrosses the substantial expulsion from the land but also involves in the process of disarticulation of moveable and immovable assets. Across the world, displacement is causing horrifying effects on the life and livelihood of uncountable people (Mishra, & Sahoo, 2015). The project affected people of Handidhua Resettlement Site are struggling a lot in order to sustain their livelihood. They were forcibly vacated from their original land with the assurance of availing continuous water supply, electricity, ponds, medical facilities etc. But the promises remain as promises only and no changes have been perceived on that aspect. Even the villagers are also demanding for the recycling of empty coalfield (Somayaji, 2008).

Even the process of displacement and the loss of livelihood has become a serious threat for the people of Singrauli region (on the border of Uttar Pradesh and Madhya Pradesh), due to the construction of dams, power plants and mining projects. The communities are in the process of being displaced with the private players setting up five super thermal power and three mining projects. But one positive thing which happened over there is that, the project affected persons seem to be in an advantageous position because of better rehabilitation and resettlement packages (Sharma & Singh, 2009). However, the favourable situation is not same everywhere. The exploitation of mineral resources has always considered as a legacy for the surrounding population in India, as it is linked with the large scale displacement on its every turn. The rough estimation on displacement due to mining between 1950 and 1990 is about 2.55 million people (Downing, 2002b). In the state of Odisha between 1951 and 1995, mining has displaced 1, 00,000 people. Of them, 40 percent have not been rehabilitated (Fernandes & Asif, 1997). Though, the Resettlement and

Rehabilitation policy came into the front to safeguard the rights of the displaced community, but it failed to draw any universal phenomenon. The proper identification of affected groups is a contradictory task. Generally, the affected communities were mostly dependent on common property resources but displacement due to mining diminished that source of livelihood. And the capital engendering from the mining projects is going directly to the dominant sections of the economy (Bhengara, 1996). Even the quick progress of opencast coal mining at the North Karanpura Valley has been wiped out the wealth of the residents of these areas. More than 200 villages got affected because of this coal mining project and the fertile agricultural land is now being transformed into mining site (Schertow, 2011).

The indigenous people consider land as a source of spirituality. But the process of displacement started mostly with land degradation, air pollution, water pollution and noise pollution. So a sense of insecurity rose due to land alienation and displacement (Ramachandraiah & Venkateswarlu 2014). The rapidity of massive displacement due to mining is also very frequent. During this situation, the project affected communities used to meet some socio-psychological issues such as depression, individuality, communalism etc. (Goessling, 2010). The impact of displacement is manifold. This can be analysed by taking the case of North Karanpura Valley. It was reported that, in this region the total land affected area is more than the leased area. Several contractors are also running several illegal mines and the local residents are forced to vacate their lands. As a result, the inhabitants are moving towards the brick kilns and stone quarry industries of the nearby states on contractual basis. Often, they work as bonded labourers. Displacement due to coal mining is not only affecting land and livelihood but also the archaeological sites and historical rock paintings (Areeparampil, 1996).

There is a huge difference between displaced communities and displacement demanding communities. The communities swallowing nuisance due to mining induced displacement and the residents demanding displacement are two conflicting situations. But the outcomes of both the situations are more or less same. The villagers of Darlipali at Ib valley coalfield of Odisha are demanding displacement due to the severity of coal mining. This village is surrounded by three opencast mines and the release of coal waste into the nearby *Lilari nallah* is making their life horrible. Undeniably, every day, they are consuming coal dust through water, inhalation and

food (Panda, 2006). Undeniably the mining industries have a major share to relegate our country in the beckon of development. But in practice, it is categorically humiliating the wealth of indigenous communities. According to Land Acquisition Act and Coal Bearing Areas Act, the mining industries are acquiring the required land, and in the process they are compensating insignificant courtesy towards the communities residing over there. In this framework, the situation of cre of land and permanent job to farmers who would be displaced Angul district is fairly pertinent. The villagers of this district joined a protest in front of Odisha Legislative Assembly by demanding the compensation of Rs. 50 Lakhs per land (The Hindu, 2011).

Generally migration occurs due to the people's aspiration to avail better amenities. But this simplistic description fails to ascertain the complexities of migration in the context of coal mining projects. Coal India Limited (CIL), the largest coal producing industry of India has its own R & R policy to compensate both the landowners and landless PAPs. Still the issue associated with its implementation requires an extensive investigation. Because, immediately after displacement people are heading towards perpetual poverty and in some times they are migrating towards slums of the cities. Even a study conducted by CIL revealed that the benefit of coal mining is stirring in the direction of a minimal section of PAPs and others are considering themselves as victims only (Madhu Bala, 2006). The infrastructural facilities are also short-term and they also will be obsolete sooner or later. The accomplishment achieved in capacity building was implausibly sustainable because of the unresponsive approach of the company officials (Bhattacharya, 2003).

One of the most prominent fundamentals of revolution in the context of livelihood at a mining set up has shown dramatic transformation since its inception. In the rapidity and extent of mineral exploration and exploitation, livelihood is deteriorating hurriedly. There is a universal fact that mining brings with it the potential negative impacts on livelihood, social life and environment (Wellstead, 2011). Subsequently, mining is not only dealing with negative impacts, but also has some positive impacts in its share. Up to some extent, the coal mining industries proved their brilliance by providing employment opportunity and some infrastructural betterment. Certainly with the prologue establishment of these coal mining projects not only the economic development grows up, but on the other hand, some serious issues like land acquisition, mass scale displacement, loss of livelihood opportunities, air, water and

noise pollution, loss of biodiversity etc. crop up. Again the rural regions which have their peculiar source of diversified livelihood are becoming resource less (Das & Mishra, 2015). Furthermore, if we will solely move towards the benefits of mining, then what will be our future as it is a short time activity only? Hence, the mining companies as well as Govt. should take the initiative to develop the area, minimize the environmental degradation and should provide proper health care and infrastructural facilities to all the mining affected communities (Mishra, 2009).

Since its inception, mining works as a positive stimulus for the rise of financial condition. But at the same time, all the mining affected people are not getting the equal benefit. In the Sangha Tri-National Park, due to gold and diamond mining a huge disparity was come across in the mean annual income of the households. The study revealed that, while some households were getting huge sums, others are deprived of it. By getting attractive endowment, the wealthy households are spending it on food, education, health and medicine, entertainment, clothes and construction of houses. On the other hand, the unfortunate households are striving hard to alleviate their poverty (Chupezi et al., 2009). As discussed earlier, mining is mostly taking place in the rural areas where people used to depend on nature and natural products to sustain their livelihood. It was observed that in Talensi-Nabdam districts of North Ghana, people were mostly dependent on farming, hunting, fishing, shea nut picking and collection of herbal medicine. But due to the introduction of artisanal and small scale gold mining, most of these sources were affected. Of them, agriculture was predominantly affected. The reasons behind the loss of agro-based livelihoods are: the decease of livestock, animal robbery, unproductive farm lands and reduced labour productivity. Again, the reason behind the death of livestock is the use of some chemicals such as cyanide and mercury. Even the routinely use of these chemicals are decreasing the grazing land which are considered as necessary elements for livestock grazing (Ontoyin & Agyemang, 2014).

Similar case was also found at Geita district of Tanzania. It was observed that, the establishment of gold mining operation is not only causing serious socio-environmental impacts, but at the same time it has severe negative impact on agricultural productivity. As per the study, in the mining region most of the inhabitants were dependent on agriculture (47.3 percent) followed by mining (33.8 percent). Here, gold mining is procuring a harmful socio-cultural influence on the

livelihoods and at the same time abandoning the agro-pastoral systems of the local people. In one way it is facilitating the local people by providing market facility but on the other side, it has been identified with the issue of crop theft (Kitula, 2006). As we discussed above, mining is a short-term activity and profitable in nature. At the same time, it is not sustainable. But during the endeavour, the local residents are losing their agro-based sources of sustenance and due to multiple factors such as lack of mechanisation and infrastructure, weak transport facility, loss of production and infertile soil are the causes behind the agricultural impasse (Cartier & Bürge, 2011).

Other than agriculture the rural community are mostly engaged on the collection of minor forest products (MFP) for the endurance of their livelihood. The Kondh tribes of KBK belt of Odisha, nurture varieties of millet, pulses, gram, pigeon pea, castor oil, honey, edible oil, mushrooms etc. They also have a strong economic relationship with the forest which empowers them to collect multiplicity of MFPs. The Kondhs used to collect MFPs for their own consumption and sometimes they generate revenues from the surpluses. But the mining claim in this region is going to destroy the economic sufficiency as well as the natural environment of these dwellers (Palit, 2010).

The LPG model of development is frequently depriving the indigenous communities across the world. For the indigenous communities, land serves as the source of livelihoods and a source of security. They have spiritual and cultural connections with their traditional land. But the acquisition of land for the purpose of development projects like mining grabs indigenous communities as immediate victims. Impoverishment arising from such forfeiture can only be substituted by providing sufficient compensation with alternative source of resource generation. In India, the states like Odisha, Chhattisgarh and Jharkhand exhilarated the mineral based industries into its annexes. But the benefits of these industries are going directly to the privileged sections of society and the downtrodden sections are disbursing the cost of its intrusion only (Meher, 2009).

The modern development process is forfeiting its value by exploiting the land and natural resource based culture. In this practise the aboriginal communities are losing their livelihood as well as the central focus of their identity and culture. So the traditional attachment with land is decreasing as it became a commodity to be sold or

leased to the highest bidder (Veiga and Hinton, 2002). In some countries like Ghana the *'culture'* of mining is very prevalent. The Ghanians are instrumental towards outmigration from diamond mining to artisanal gold mining with a desire to 'get rich quick'. The financial benefit in the gold mining sector is fairly appealing than that of diamond mining (Hilson, 2010).

The neo-liberal economic and political reforms of Peru are instrumental to place the country in the global market through foreign direct investment. As a consequence, mineral extraction activities started on the name of economic growth, export-led earnings and foreign direct investment. Ever since its operation, the perpendicular production tactics of households have been considerably exaggerated. Previously the households draw their primary source of livelihood from the natural resources and also involved in diversify agricultural, livestock and small market activities. But the revolution transpired when Newmont Mining Corporation's Yanacocha (MYSA) started its operation. Though it has been reported that some communities acknowledged their magnificent access to economic and human resources, still all the households loss their access to natural and social resources (Bury, 2005).

Besides the loss of agriculture and MFP, the major issue of mining is the land-based disputes. Depending on the nature and pattern of mining, it compels the native residents to engage themselves in varied land based conflicts. Due to the inherent need of the mining industry, mining necessitates the destruction of forest land, homestead land as well as farm lands. In the Upper Hunter region of Australia, the license for mineral exploration was granted without any landowners consent. In addition to this, it can be mentioned that, the granted land of this region is the fertile agricultural land which generates the source of livelihood of this region. But the establishment of both opencast and underground mines is decreasing the ground water level as well as modifying the external structure of land which ultimately involves with numerous land use conflicts (PIA, 2011). Even the loss of natural vegetation and land based livelihood is developing varied unrests among the local residents and mining authorities (Taabazuing et al., 2012).

Mining is responsible for the loss of land and land use pattern. Sometimes, coal extraction is leading some sort of land use conflicts with the native inhabitants. Local residents used to oppose the establishment of mining industries as they fear that it will

hinder their usual pattern of livelihood. In the Anugul-Talcher region of Odisha, between 1973 and 2007, a huge alteration in the land use pattern was observed. In this belt, the increase of industrial activities is the major cause behind the loss of land. Of them, the expansion of coal mining projects by MCL is responsible for the alteration of water bodies, forest land, agricultural land and barren land (Singh et al., 2010). The modification of these units are ultimately causing disharmony among the local people, government and industrial authorities. While the conflict develops, it not only hampers the environment and land-based source of livelihood but at the same time it obstructs some frequent costs of the mining industries. The costs of extractive industries can be cited as loss of mineral production due to delay, inability to pursue further projects, need of additional staff for conflict resolution etc. However, all these costs can be resolved by developing a community relation approach which could provide wider circumstances by taking social, environmental and cultural aspects into account (Davis & Franks, 2011).

1.3.Mining, Environment and Health

No doubt development ventures go hand-in-hand with environmental impact. On the other hand the outcome in the context of benefit can be measured much before the initiation of any project. Some preliminary alertness such as Environmental Impact Assessment (EIA) can be anticipated as an extent for feasible variations in environment. The mechanization process of opencast mining has a great hand for the deterioration of environmental quality (Ghose & Majee, 2000).

With the establishment of MCL (Mahanadi Coalfields Limited) and NTPC (National Thermal Power Corporation), the social environment, natural vegetation and agricultural crops have been affected in Angul-Talcher belt of Odisha. Due to these interventions there is a considerable fall in biomass production. It was reported that every day, the joint venture of these mines are drawing 25 crores litres of water from river Brahmani and are discharging gallons of waste water into the nearby river Nandira. Besides this, the presence of metallic substances in the waste water is causing varieties of health hazards. Of them, fluoride pollution is very severe in this belt. Because of this, the incidence of white spots all over the body, incurable skin infections and lumps of dead skin are increasing. Besides this, forest is degrading day by day and seed germination has become slow down (Panda, n.d.).

Coal mining acts as an active agent for the economic development of many countries including India (Chaulya & Chakraborty, 1995). Aimed at gratifying the industrial hassles, transportation of coal through haul and transportation roads are engendering about 80 percent of entire dust radiation into the environment. And this emission of dust has a direct impact not only on the health and biodiversity but also on the aesthetic beauty at a large scale (Chaulya et al., 2011). Studies on environmental impact of opencast coal mining portray a comprehensive depiction about its local environment. The nature and magnitude of hazardous conditions can be drawn by analyzing the factors like population density, topography and weather, attitude of local people towards mining and by the nature of the community. The unplanned disposal of coal wastes, fluctuation of temperature, movement of heavy vehicles etc. have a negative impact on the environment. The noise of blasting creates the effect of air blast wave which usually supplements the blasting vibrations on the community (Tomlinson, 1982). The study on truck haulage dust revealed that especially wind, distance and road treatment conditions affected the dust localities next to 50 ft from and 100 ft away from the uncovered transport road and it creates the major amount of fugitive dust (Reed & Organiscak, 2005).

All most all the mining activities across the world are involved directly or indirectly with air pollution (Singh, Pal & Tiwari, 2007). The primary sources of air pollution in the coal mining regions embrace the loading and unloading of overburden and coal, size reduction, blasting, drilling and transportation (Higginbotham et al., 2010a). In this regard the primary contaminants of opencast mining viz. total suspended particulate (TSP) matter and Inhalable particulate (PM^{10}) are the major concern for increased respiratory symptoms, aggravation of asthma, premature death etc. The elderly, children and people with asthma or heart disease are the most vulnerable sections of this (Chaulya, 2003; Higginbotham et al., 2010b). The conditions under which the workers perform their duty have a great bearing on their general health, efficiency and productivity. The performance is affected by environmental problem such as temperature, noise, ventilation, humidity, work-zone air-quality and ambient air quality. The continuous exposure of the miners to such unhealthy atmosphere leads to fatigue and boredom ultimately leading to the serious fatal accidents. Mining work is the principal occupation of workers of mining area. Due to inadequacy of their earnings they are depending upon subsidiary occupations like sale of forest

products, small business like battle shop, poultry, goatery etc. to supplement their earnings. Majority of workers work in underground mines which is less mechanized. Blasting, drilling and the breaking of big pieces into small create noise. Even the movement of transported vehicles creates noise. Smell of chemical explosion, coal dust, carbon monoxide through transportation, gases in underground mines affect the respiratory system. Occupational hazards are present due to the factors like negligence, carelessness, vanity and material factors like unguarded and defected machinery, chemical explosives, defective equipment etc. are responsible (Naik & Pradhan, 2010).

The recent past of mineral industry witnessed a wide range of sustainable development notions. But the conflict on the distribution of impacts and benefits over development resources are important. In some countries like Australia the 'social license to operate' a mine is regarded as an essential element to regulate the mining activities. The extent and intricacy of social dimensions of mining in Australia are demanding integrated and interdisciplinary approaches for the research, policy and practice (Solomon, Katz, & Lovel, 2008). As of now both the government and non-government organizations are demanding that the mining companies should plan to mitigate various plans and policies for the betterment of society as well as its environment. The most comprehensive aspect which needs to look after is the health aspect of mining community. In their sustainable development framework the International Council on Mining and Metals (ICMM) identified that the corporate members are committed to measure their own performance against ten principals. Under 5^{th} principal it focused on the continued improvement of health and safety. The ICMM includes that the management system should focus on all the aspects of health and safety of all the employees, contractors and the nearby communities (ICMM, 2012 & 2014). In northern Canada, coal mining has a negative impact on community health. The interviewees of this region stated that, appropriate attention is required from the mining industries, policy makers, planners, specifically on the aspects of family counselling, maternity and child care, implementation of drug and alcohol policies, safety training opportunities and adequate rehabilitation service. According to them these major issues should be taken care of both by the government and mining (Shandro et al., 2011).

The mental health and wellbeing of the resident workers are the effective measures to assess the satisfaction level. More specifically the workplace culture and the closeness between the colleagues build the friendship ties among the workers and management communities. But the study done by Mclean revealed that the mental health of the workers is quite appealing as the organizational support structure is quite better. It also revealed that the relationship between the family members, co-workers and management are the positive impact factors for the economical and mental wellbeing of the workforce (Mclean, 2012).

ICML, the first privately owned and operated mine in India is successfully running near Jharkhand-West Bengal Boarder of Eastern India. It's a part of World Bank Programme called the BDP (World Bank's Business Partners for Development Programme) which deals with oil, gas and mining sector. The Sarishatali Coal mine of ICML runs its activity in Barabani which is located in the Burdwan District (Bardhaman), near West-Bengal, Jharkhand and border of the Ranigunj coal belt. The coal communities are dependent upon agriculture. But water is a constant problem for agriculture here. So for this reason the local people and the people from Barbani of Jharkhand work in these collieries. A whole day work which varies from 10-12 hours, earns them between 40-50 rupees, which is far less than the daily wages. But after the shutdown of ECL and Raniganj Coalfield, the workers turned to work under coal mafias who were engaged to run illegal mines. In this regard before starting its mining activities ICML undertook some developmental projects through its tri-sector partnerships to solve the problems of local inhabitants which may originate for its activities. It was involved in some community development programmes like income generation, provided health care facility, constructed link-roads and school buildings etc. For use in a power plant, coal with a Volatile Matter 20 is preferred, but typically Indian power plants use coal with a VM 12 or higher. Below this value the coal is usually discarded. In order to make the seven mine-affected villages more financially dependent, it started distribution of coals in a quota basis and declared that the villagers can use it for their personal purposes or can sold it to earn a little extra cash which led to 80-250 rupees earning per day. In December 2000, it started a partnership with the local NGO ASHA, with the goal of identifying the most significant health issues which the local communities were facing. And this agreed vision provided safe drinking water, improved the sanitation in the operational area,

controlled the communicable diseases, promoted family planning measures, promoted mother and child health care etc. The authorities also constructed link road from Sarishatali coal mine to Barbani railway station. Several link roads have been constructed as a part of the BDP "focus group" tri-sector partnership. In view ICML can be used, as an example for India's big mine operations on how to run a profitable mine, while guaranteeing that local community and environment are protected (Konar, 2007).

The health hazards and degeneration of the health conditions of women and children is one of the most serious impacts of coal mining. The effect of chemicals and radiation from the ores has direct impacts on women's health. One of the most serious impacts has been the suffering of women living in the proximity of uranium mines of Jaduguda where radiation levels are scientifically proved to be above permissible limits. Here miscarriages and birth of physically and birth of physically and mentally deformed children are very common. Deaths and terminal diseases like leukaemia and thalassemia are decreasing day by day (Mines and Communities, 2003). Even women and children who are not working in the mines are constantly exposed to various respiratory illnesses due to inhalation of dust particles and experience multi-functioning of various sensory organs, which has a long-term impact on their reproductive health. Noise and dust pollution affects women the most during pregnancy. Also the presence of metals like fluoride, manganese, nickel and sulphate are high in concentration which affects mostly the pregnant women and the foetuses. And the most common diseases among them are tuberculosis, cough and cold, malaria, skin diseases, diarrhoea, staining of teeth, joints pain, arthritis, lethargy etc. (Priyadarshi, 2010).

The impact of Mica mining on women in the Sydapuram Mandal of Gudur area in Andhra Pradesh is very pathetic. It was observed that, one third of the workers are widowed women as their husbands are succumbed to "silicosis-tuberculosis". At workplace, women are doing mostly the crushing, sorting and dusty duties by working in the milling and processing units with limited protected clothing or equipment. While working in this atmosphere, their continuous exposure with the toxic and polluted air is leading to complicated health implications includes various lung diseases and even varied forms of cancers. Even, the interference of toxins is causing reproductive, menstrual, pre and post-natal complications, anaemic conditions,

gastrological illness and anorexic malnutrition. It was also reported that mining has contaminated the water regimes of this region as they looks murky in colour with no choice left for residents and are facing several health complications(Wright, 2004). Besides health, the social life of both domestic and political women of coal mining communities in Northumberland was carried out by focusing upon three collieries i.e., Ashington, Bedlington and Newbiggin. The study revealed that in case of domestic women the problems such as lack of women's employment by the mining company, contract marriage and the need of husband's permission to go outside are the emerging issues. Besides this, drinking and gambling habits of men creates unhealthy environment within the household. Moreover, the causes of high death rate are pleurisy, bronchitis, anaemia, frequent pregnancy, polluted environment; blood diseases etc. in contrast to this condition of domestic women the political women are more empowered though they have their roots in the culture and traditions of the mining community (Hall, 2001).

1.4.Mining and Socio-economic Aspects

While discussing about the macro level changes of mining, micro-level aspects cannot be overlooked. It was observed that, although mining has provided the arena for better infrastructural development and rise of financial capital, at the same time it is responsible for varieties of socio-economic issues. Mining can be held responsible for viable economic development of a region. But at the same time it fails to bring equality among the project affected communities (Perry, 1982). With better employment opportunity, mining also affords the environment for expenditure on varieties of aspects such as health and housing. Basically, mining is a profitable juncture for state and central level economic development but its regional impact is very restricted in nature (Rolfe et al., 2007). However, mining necessitates mass scale acquisition of land which reduces the accessibility of affordable housing and also responsible for local emergency services. Simultaneously, mining affected mass is getting involved in varied criminal and anti-social activities. While the present generation is passing through the social distresses such as inequality, disempowerment, and competition leaving its foot prints for the future generation to continue the same (Colagiuri, Cochrane & Girgis, 2012). However, the mining companies are spreading the awareness among the local communes regarding the short term benefits and ignoring the spreading of any awareness regarding the

negative outcomes such as displacement, relocation and pollution (Badera & Kocoń, 2014).

The introduction of coal mining projects embracing some other socio-economic issues such as depletion of crop land, pollution of water bodies, increase of landless farmers etc. The rural residents are entirely dependent on land to sustain their livelihood. But the expansion of mining activities is not only displacing them from their major sources of livelihood but simultaneously forcing them to become landless farmers (Hu et al., 2014). This situation forces them to deviate from their own cultural inheritances as they have emotional and cultural affinity with their indigenous farmlands (Christison, 2003). However, a minimal development is being taking place in the economic aspect of project affected people. This can be cited in the fold of infrastructural developments such as schools, clinics, roads, boreholes and pipe water supply (Appiah & Buaben, 2012). But the local residents express their dissatisfaction regarding the economic development which resulted as strikes, road blocks, and destruction of company's assets (Garvin, McGee, Smoyer-Tomic, & Aubynn, 2009). Though the mining companies are justifying their CSR activities, but without the presence of community relations and development (CRD) functions, they are doing only 'core business'. But for the successful implementation of sustainable development agenda, the functional equity needs to be established (Kemp & Owen, 2013).

In the aftermath of mining, the authorities are mining companies adopting the mechanisation process which in turn increased the production and reduced the employment opportunity of the local residents. In West Virginia, the growing environmental consequences and technological advancements are the reason behind the increased number of jobless persons (Bell & York, 2010). But by employing effective community-company relation, the socio-economic development could be attained. In the gold Fields of Ghana, the effective mechanisms such as resolution of conflict, community development programmes, training for employment and adoption of widespread environmental monitoring agenda are being taking place for the sustainable development of the mining affected community (Yirenkyi, 2008).

1.5.Mining & Gender

Gender dimension of mining is utterly significant as this section of society is greatly affected by mining. From the policy perspective of mining, less attention was given regarding the gender issues of mining sector. Even in the decision making process of mining industry, women communities were highly neglected (Dutt, 2011). Generally, women communities have greater affinity with the nature based products. But due to mining this aspect is severely being deteriorated. However, the acquisition of land for mining is bringing total transformation in the context of women's livelihood. Because the compensation amount is going directly to the male members of household and women are becoming non-productive residents (Dutt & Mahy, n.d.). Traditionally, women community had significant involvement in the collection of forest based products, management of livestock and also had substantial participation in agricultural production. But the process of displacement and land acquisition is not only restricting them to continue the same but at the same time, it interrupts their economic sovereignty (Panigrahi, 2015 & Bhanumathi, n.d.).

Women are mostly neglected in the resettlement and rehabilitation policy of mining (Akabzaa & Darimani, 2001). Though the women community is availing the opportunity to work in the mines, they are receiving subordinate status and also performing low skilled employments which at times unsafe and hazardous (Dutt, 2008). This in turn is accountable for varied psychological issues among women (Burvill, 1975). While family and kinship support are two significant attributes for job and life satisfaction, in absence of these aspects the workers used to alienate from their peer groups as well as families (Iverson & Maguire, 2000). However, the isolate and stressful working condition can even cause behavioural disorder (Neil, 1988). But due to low family income, they join the mining centred workforce (Ngos, Miners, & Ilo, 2010). By joining the labour force, no doubt the women communities are earning for their household expenditure. At the same time their regular exposure to the mining and quarrying industries is developing varieties of health problems through infected air, water and dust. Besides this, they are also experiencing some involuntary servitude such as workplace harassment, domestic violence and sexual exploitation (CCSG Associates, 2004). The gender aspect of mining is more or less same everywhere. Still, mining can be proved as beneficial from the economic perspectives by avoiding gender biasness (Mishra & Reddy, 2012).

1.6.Statement of the Problem

Ever since the inception of mining industries, the stakeholders of these projects are ruthlessly trying to avoid and mitigate the unpleasant effects on the flimsy eco-systems and local communities. Both the state and central government bodies are keeping them busy in formulating and adapting the new policies for the betterment of the project affected communities. Even the mining companies are also struggling to be better environmental citizens. Various protest movements have been mushroomed and environmental activists have become involved in the mining related disputes. However, a lot need to be done to ensure that mining is carried out in a more sustainable way. Not only the above issues, there are some other issues that are vital in order to address the subject-matter of coal mining with specific reference to developing countries like India. Undoubtedly, with the invasion of coal mining projects the country is becoming resource rich and the government is earning good revenue but the pessimistic consequences in form of water, air and noise pollution, disturbance of social structure, and indigenous culture, disruption of inter-personal ties, degradation of health, and loss in agricultural production of the project affected communities are not taken into account. Though few studies have emphasised on it, they have mostly confined to environmental and economic aspects. If we will not focus on these sociological and anthropological aspects of coal mining, it will be difficult not only to extract coal for our sustainable future energy requirement but will also create a wide range of social movement putting the rural livelihoods in the risk. So, it is need of the hour to assess the socio-economic, structural and health impact of coal mining on rural livelihoods. In the absence of such assessment the present benefits could be at the cost of other resources/ communities or future generations.

1.7. Research Question

Varieties of mega projects are at work in many states on the name of development. Of the developmental projects coal mining is a profitable business and occupied an important position for the growth of world economy. Still it has some drawbacks. Hence the present study will focus on some issues such as how does mining influence the livelihoods of local people? To what extent mining has given justice to project affected communities? And what exactly are the benefits / costs of the mining projects? How can benefits and indeed potential negative outcomes be assessed? Does mining support/ provide sustainable livelihoods to the project affected communities? In what extent it influence rural health? With these questions in mind the present

study concentrates on the socio-economic, structural, livelihood and health effects of coal mining in the Ib valley coalfield of Odisha.

1.8. Specific Objectives of the Study

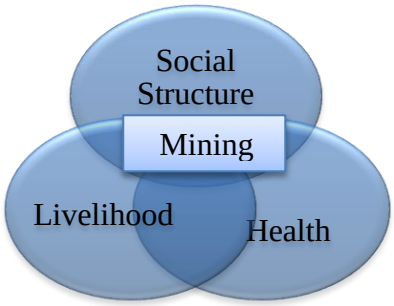
Objective is nothing but the targeted goal which the researcher intends to fulfil with the due course of time having some aims behind it. Likewise every research has its aim which seeks the results to be fulfilled. So the present study will be carried out by keeping in mind the three major objectives. The specific objectives of the study include:-

- To explore the impact of coal mining on the rural social structure
- To analyse the impact of coal mining on the local communities and their livelihood with special reference to Ib Valley coalfield.
- To assess the adverse effects of coal mining on the health condition of rural people.

1.9. Conceptual Framework of the Study

A company produces coal, consumers use coal as energy or power and governments get revenue. But all indirect effects are borne by the people, who stay in the vicinity of mines. They lose their land, forest with which they had symbiotic relationship. Their traditional source of livelihood affected completely. With the advance of coal mining, local communities used to leave their lands and moved to other places. In the process their social network disrupts, pollution of nearby area rises and it also has a negative impact on health. At the same time, agricultural production decreases day by day. Even sometimes it forced them to lose their culture and identity along with lose of resources. No doubt, most of the project affected communities benefited economically but no body counts their socio cultural lose. Until we analyse the cost and benefits of coal mining from the context of socio-cultural and economic perspectives it will be difficult to assess the loss. In this study, three major impacts are proposed to be included. They are impact on social structure, health and livelihoods.

Figure No. 1.2: Conceptual Framework



While discussing the socio-economic impact of mining some sociological theories are being interlinked.While discussing on social structure an emphasis was given on Granovetter's strength of weak ties and Durkheim's view on social solidarity. In the context of livelihood, while linking the primary data with sustainable livelihood frame-work of DFID, Marxian view on Alienation was being discussed.

1.9.1. Theory of Alienation

Alienation is a dominant theme of Marxian ideology. He developed this theory to cater various human activities which are accountable as unprejudiced powers of prevailing society (Cox, 1998). During the early phase, Karl Marx's philosophical writings were influenced by the Phenomenology of Hegel. And in due course of time Marx was instrumental to define that the history of mankind had a double aspect. The first one deals with the history of increasing control of man over nature, and the second one deals with the history of increasing alienation of man. 'Alienation' can be pronounced as an ailment where men are conquered by the means of their own creation which threatens them as alien powers. Further, he compiled that in a capitalist society all the institutional agencies such as the state, religion and political economy, are going through a noticeable circumstance of alienation (Coser, 1998, p. 50-51).

For Marx, in a capitalist society alienation is profoundly imbedded in its social structure. According to him, it is social structure 'that acts to break down the natural interconnections that characterise human nature in an ideal sense'. In this connection he developed an idea of two class system i.e., the capitalists or bourgeoisie class and workers or proletariat class. The capitalists provide employment to the workers in virtue of capturing their labour and time by providing the means (tools and raw materials) of production. For the endurance of their livelihood, it becomes mandatory

for the workers to sell their labour times in the hands of capitalists (Ritzer, 1996, p. 57a).

Marx documented four modes of alienation; alienation from the productive activity, alienation from the product, alienation from himself and alienation from fellow workers. In a capitalist society the workers are like actors, who used to act as per the direction given by the capitalists. Instead, working for themselves, they used to work as per the requirement of their employers. The workers have no right over the product which they are producing in lieu of wage. In this state of affairs the workers turn out to be alienated from their own products and productive activity. Being alienated from the objects of his labour and the process of production, man gets alienated from himself as he fails to improve the voracious edges of him. Finally, the workers in a capitalist society forced to work isolated because of nature of their work. And sometimes the attitude to grow more also results as a consequence of man's alienation from his fellow workers (Ritzer, 1996, p. 57-58b).

In the present study, the theory of alienation will be employed in the context of livelihood to analyse the four modes of alienation on labour productivity.

1.9.2. Ruthenberg's Rotation Value

The theory of rotation (R) value was developed by Hans Ruthenberg while researching on 'Farming Systems in the Tropics'. He discussed about three characteristics of farming in the tropics: (a) natural environment (b) some critical aspects and (c) dynamics of tropical farming. Again, natural environment involves climatic influence, soil condition and biological environment. The critical aspect covers soil fertility, risk and uncertainty, low labour productivity and seasonality. All these factors are significantly responsible for farming. Of them, climate and soil fertility are the basic features which affects the agricultural productivity. But sometimes, people used to practise their indigenous pattern of soil conservation such as use of organic waste, burning of natural vegetation and following the fallow period. While explaining the fallow period, Ruthenberg deliberated the 'R' value which describes the relationship between crop cultivation and fallowing. According to him when the 'R' value goes beyond 66, it implies that permanency of farming is there. But when the 'R' value reaches 150, it indicates that 50 percent region is carrying out two crops in a year. Similarly, when the 'R' value touches 300, it implies that three

crops are being practised in a year. It can be representing as: R= C×100/C+F. Here, C is the cropping period in years and F is the Fallow period.

In the present study, the mining affected people are following a fallow period to regenerate the soil fertility. In the mining affected villages the continuous release of coal dust and waste particles are the central reason behind the practise of fallow period. In order to analyse the accuracy of this attribute, the 'R' value will be calculated in the chapter no. six which deals with the impact of mining on agricultural productivity.

1.9.3. The Strength of Weak Ties

Granovetter suggested that analysis of social network is a tool for linking micro and macro level sociological theories. This theory illustrated that the degree of overlap of two individuals' friendship networks varies directly with the strength of their tie to another. The impact of this principle on diffusion of influence and information, mobility opportunity and community organization is explored. Stress is lead on the cohesive power of weak ties (Granovetter, 1983). According to Granovettor, most of the sociological theories gave importance on the macro level phenomena such as social mobility, community organization and political structure but did not transmit micro-level interactions to macro-level patterns with the help of any substantial approach. So the theory of 'strength of weak ties' analyses the process in which the interpersonal networks provides the most fruitful micro-macro bridge. In this network analysis theory the "strength" of an interpersonal tie should satisfy the strength of a tie which combines the amount of time, the emotional intensity, the intimacy and the reciprocal services which characterize the tie. To justify this, Granovetter proposed a framework where he arbitrarily selected two individuals and called them as A and B-- and set, S= C,D,E,…, of all persons with ties to either or both of them. The hypothesis which enables us to relate dyadic ties with larger structures are: the stronger the tie between A and B, the larger the proportion of individuals in S to whom they will both be tied, that is, connected by a strong or weak tie. This overlap in their friendship circles is predicted to be least when their tie is absent, most when it is strong and intermediate when it is weak.

In the present study this theory will try to analyse the change in structure and function of family, the intrapersonal kinship relation, the transformed Jajmani system and

power relation, non-observance of rituals and festivals and discontinuity of community relation etc. It will also focus on the factors affecting the network ties between the mining affected communities. Finally it will observe the type of tie (i.e. strong or weak) persists among the mining affected villagers of Ib valley.

1.9.4. Social Solidarity

Durkheim's theory of solidarity is the collective conscience which is the sum total of beliefs and sentiments common to the average members of society and forming a system in its own right. This collective conscience, a distinct reality which persists through time and unites generations, is a product of human similarities. It persists in societies where it has its own properties, conditions of existence and a distinct mode of development. In this type of society the collective conscience among the individuals is the rudimentary norms of existence (Abraham & Morgan, 1985a).

Durkheim acknowledged two forms of solidarity: mechanical and organic. Mechanical solidarity is the solidarity of resemblance where people are homogenous mentally and morally, they feel the same emotions, cherish the same values and hold the same things sacred. The society which represents mechanical solidarity is normally categorized by strong collective conscience. On the other hand, organic solidarity represents the differences among the individuals particularly in a modern industrial society. A society having organic solidarity is characterized by specialization, division of labour and individualism. It is held together by the interdependence of parts, rather than by the homogeneity of elements (Abraham & Morgan, 1985b).

However, from the above assertion it is clear that the society exhibits two types of solidarity. In the present research, the society is of two types i.e. agrarian and mining. So the present theory will analyse that, what type of solidarity persists among the mining affected and control villagers.

1.9.5. DFID's Livelihood Framework

Livelihood itself is a broader aspect. Thus a proper framework is necessary to explain the several aspects of livelihood. Several studies were being carried out with the help of Sustainable Livelihoods (SL) Approach. But the SL approach developed by DFID is considered as the parent model of livelihood. This livelihoods approach is

concerned first and foremost with people. It seeks to gain an accurate and realistic understanding of people's strengths (assets or capital endowments) and how they convert them into positive livelihood outcomes; no single category of assets on its own is sufficient to yield all the many and varied livelihood outcomes that people seek. This is particularly true for poor people whose access to any given category of assets tends to be very limited. As a result they have to seek ways of nurturing and combining the assets they have in an innovative ways to ensure survival (DFID). DFID's livelihood framework identifies five core asset categories upon which livelihoods are built. They are: Social Capital, Human Capital, Financial Capital, Natural Capital and Physical Capital.

There is much debate about what exactly is meant by the term 'social capital'. In the context of the sustainable livelihoods frame work it is considered the social resources upon which people draw in pursuit of their livelihood objectives. These are developed through networks and connectedness, membership of more formalised groups and relationships of trust, reciprocity and exchanges that facilitate co-operation, reduce transaction costs and may provide the basis for informal safety nets amongst the poor (DFID, 1999a).

1.10. Methodology

This section deals with the rationale, methods and techniques which were used by the researcher to carry out the present study. The study is basically an intensive fieldwork conducted in the Ib valley coalfield of Jharsuguda district, Odisha, during the months of May 2013 to November 2013. Much before the instigation of field work a pilot study was conducted during the month of March 2013. On the basis of that pilot study, six mining affected villages near three opencast mines (Belpahar OCP, Lakhanpur OCM and Samaleswari OCP) from IB valley and Lakhanpur area were chosen for final study.

To justify the socio-economic impact of coal mining, the present study made an attempt to compare between two areas- one is affected by mining and another is non-mining as control group. While selecting the control group certain factors such as the social composition, the agro-climatic zone, district, source of livelihoods was taken into consideration. An initiation was made to collect information of both pre mining with post mining and at the same time the present situation of control villages with the

situation of that particular control village during pre-mining period i.e. during 1990. Here it can be mentioned that though the mining company entered into this mining affected region during 1984, it took around 5-6 years' for its real operation and land possession. During pilot study the researcher found that the socio-economic condition, source of livelihood, agro-climatic condition and infrastructural development before nineties was more or less similar in both the mining affected villages and control villages. It was also observed that in the mining affected villages, some changes occurred in the structure of demography due to the inclusion of mining. But in the control villages, the demographic structure is more or less same as no immigration held in this area except few migrations. So it was felt that taking the pre mining information in the mining affected areas and the pre mining situation in control villages (before 1990) will be nothing but a repetition and it will increase the volume without giving a scientific justification. Hence, the present study was undertaken by comparing the impact of mining between the pre-mining and post-mining villages and at the same time the control groups without the intervention of mining activities.

1.10.1. Universe of the Study

The study was carried out in Ib valley coalfield of Odisha, India. It derived its name from the river Ib, a tributary of Mahanadi River. Again the coalfields of Odisha are functioning under the jurisdiction of Mahanadi Coalfields Limited (MCL), which is a subsidiary of Coal India Limited (CIL). Ib valley coalfield is located at Jharsuguda and Sundargarh districts of Odisha. However, the present study is confined to the opencast mining region of Jharsuguda district.

1.10.2. Rationale behind Selection of the Study Area

Ib Valley coalfield of Odisha was selected purposively for the present study. While reviewing the literatures, the researcher came across the fact that opencast mines are most affective than the underground mines. Owing to this reason, and on the basis of harshness, three opencast mine sites i.e. Lakhanpur OCP, Belpahar OCP and Samaleswari OCP were selected for final study. While selecting the study area, some prior information was gathered about it. According to this, at Ib valley, thousand acres of land have been affected and the process of ecological degradation is going on because of coal mining. The blasts taking place and the movement of heavy vehicles are the common causes of noise pollution in this belt. Environmental hazards like air,

water and noise pollution are causing serious diseases like asthma, respiratory disorder, skin infection etc. After collecting these few data about Ib valley coalfield of Odisha, and for a curiosity to collect detailed assessment on the livelihood, agricultural, socio-economic, ecological and health perspectives, the researcher decided to take up this area for her study. While selecting Ib valley the following criteria were taken into consideration.

- Researchers put their interest to do numerous studies at the Talcher coalfield of MCL, but handful of research was undertaken at Ib valley coalfield.
- Due to strong agitation, campaigning and brilliant leadership, the compensation process at Talcher coalfield is noticeable up to some extent, but the lack of all these attributes is causing more vulnerability at Ib valley.
- Study conducted by MoEF at 88 industrial clusters of India described that the districts such as Dhanbad, Korba, Angul, Talcher, Jharsuguda and Singrauli are the critically affected regions of air pollution due to coal mining.
- As per the Annual Sustainability Report of MCL, during 2012-13 the total emission of TPM at Ib valley was 8042.847 tonnes which is more than Talcher coalfield.
- Continuous release of waste water into the nearby Ib River is responsible for innumerable health hazards such as TB, asthma, malaria, gastro-intestinal etc.
- Acquisition of land for mining has altered the livelihood scenario of Ib valley

As it was discussed earlier, opencast projects came into existence in the year of 1984. However till date only few studies relating to the impact of coal mining in this area is being held. And all most all the studies carried out here focused on economic and environment aspects. But the absence of research on socio-economic aspects is a lacuna over here. After collecting these data about Ib valley coalfield of Odisha, and for a curiosity to collect detailed assessment, the present study anticipates to bridge the gap by focusing on socio-economic aspects

1.10.3. Sampling Procedure

In the words of Goode and Hatt (1952), sampling is the smaller representation of a larger whole. Sometimes, due to varied reasons such as time constraints, it becomes impossible to study each and every individual of a targeted population. In this situation, the researcher follows the sampling procedure to collect the required

information. The present study was carried out from a sociological perspective. Based on the severity three opencast mines in the Ib valley coalfield area was selected for final study. In the present study the target population are those, who are continuously affected by mining and still continuing their stay near mining vicinity. So the population is easy to identify by taking all the villages, which are near the mines. In course of field visit and through the discussion with the MCL officials, a list of severely affected villages of each mine sites was prepared. In the next step, a list of 18 most affected villages was prepared which were within three kilometre of radius from the active mines. The closer a village is to the mines the more is the probability of getting affected by mining. On the basis of this fact, six most affected villages within 3 kilometre radius of above mentioned mines were selected.

As part of control group two villages were selected for a comparison. Irrespective of the size of the villages, 50 households from each village were selected with the help of systematic random sampling method. Finally 300 households were selected from the mining affected villages and 100 households from the control villages.

1.10.4. Systematic Sampling

In systematic sampling, larger population can be selected at any random starting point with a fixed periodic interval. The interval is called as the sampling interval and it can be calculated through dividing the population size by the preferred sample size.

It can be represented as: K=N/n.
Where, N= population size
n= sample size

According to the application of systematic sampling, it can be applied in such a situation, where the population is homogenous. At the same time, it provides significant importance on the fact that the preferred sampling interval should not hide any important aspect of the studied universe. In the present research, the population size of each village was collected from the respective Anganwadi centres of each village. Then, the K^{th} item for each village was calculated to proceed systematically.

1.10.5. Extensive Fieldwork and Establishing Rapport with the Villagers

The researcher reached the study area on 2nd May 2013 for the first time. She managed to get a rented house in the Gumadera area of Belpahar on arrival. During the period of pilot study, the researcher got a fair idea of the region and its people. Based on that, she took the decision to stay at Belpahar as it is the middle place of Lakhanpur and Ib valley area. Though it was the month of May, the weather at that time was very unbearable. The uniform temperature during that time was between 47° to 50º Celsius and continuous power-cut was a very common thing. Apart from this, getting pure drinking water was a major challenge, for which the researcher need to depend on market. Then, slowly the researcher copped with the situation and arranged one vehicle for the purpose of field visit. Once everything was settled down, the real field work was started with a visit to Khairkuni village. It was very tragic while driving towards this village. The road condition was totally awful, and the noise coming out of the heavy vehicles made the researcher panic. After reaching the village, at the first sight saw many women and men were standing near the water tape with water containers of different sizes. Upon interacting with them, they replied that there will be water supply only for 30 minutes and nobody wants to miss out the crucial time to get their share of water. Khairkuni is a displaced village of Lakhanpur OCP and because of the strong leadership and continuous agitation, the infrastructural facility of that village is quite better. As the researcher was perceived as a spy of MCL by the villagers, it took some more time to cope with the situation. The situation was quite obvious. Since 1889 the local people were in such a hardship that they lose their faith mostly on strangers. However, with the process of interaction they amalgamated with the researcher and also participated in the focused group sessions.

Gradually the researcher was able to make good rapport with the villagers of Kudopali, Kantatikira, Ainlapali, Darlipali and Ubuda gradually. The local people got to know the researcher very well and in the process of interview schedule, they expressed many heart touching realities. But the most common adversities with all the mining villages are the scarcity of water, ill health, inadequate health care facility, fear of displacement, development of self-centred attitude etc. Generally, the villages of India are called as the museum of ethnic and cultural artefacts. But this aspect was not present even in a skeleton form in any of the mining villages.

It was really disheartening to work in the Darlipali village. This village is surrounded by three opencast mines i.e., Lakhanpur OCM, Lilari OCP and Belpahar OCP. According to the villagers, they consume about 200 gm of coal dust through water, inhalation and food every day. All the three opencast mines are disposing their waste water into the *Lilari Nallah* which is the only source of water for bathing and washing of these villagers. The noise coming from the blasting is making their life miserable.

1.11. Sources of Data

The study is primarily based on intensive fieldwork, which was carried out for a period of six months. Further, the study is a qualitative micro-level study aiming to understand the impact of coal mining in the selected villages. In order to fulfill the objectives of current study, data was collected from both primary and secondary sources. For primary data collection, apart from quantitative techniques the study employed qualitative sociological and anthropological tools. As part of qualitative data collection, the techniques like observation (both participant and non-participant), case study, key informant interview, formal and informal interviews, and some of the PRA techniques like focused group discussions, were used. For gathering quantitative data household survey was conducted using the pre-tested household schedules. Audio-Video accessories were also used for the collection of primary data. The secondary data were collected from official records, policy documents, published reports of similar projects, journals and literature from social science discipline

1.11.1. Primary Data Collection

1.11.1.1. Observation

Data was collected by employing both the participant and non-participant observation methods. To fulfil the demand of participant observation method the researcher decided to stay in the Gumadera area of Belpahar, which was only 7 kilometres away from Lakhanpur OCM. This was the middle place of both Ib valley and Lakhanpur area. The impact of mining on the villager's income, health, water quality, environment, biodiversity, cropping pattern, use of seed, fertiliser and pesticides, source of water for farming, pollution and the traditional and modern ways of cultural practises were observed. During the field visit the researcher was able to catch the first-hand information about water quality, roadways and the situation of blasting. Impact of mining on family structure and function, marriage pattern, kinship relation,

Jajmani system, observance of community and household level festivals etc. were also closely observed.

1.11.1.2. Interview

Data was collected with the help of structured and semi-structured interview schedule. In the process, local residents, local political leaders, MCL authorities and other government and non-government officials were also interviewed with the help of interview schedule. The first segment deals with the general information about the households' family particulars (family members, age, sex, education, activities status and occupation), sources of income, land details, cost of cultivation and assets were asked. Second section is about land acquisition and compensation was attempted. In the third section awareness of pollution: when they first noticed the pollution, multiplicities of pollution, and then the order of intensity was gathered. The fourth section focused on the impact of mining on cropping pattern, land use pattern, mechanization, use of seed, fertilizer and pesticides etc. were asked. The fifth section is about impact on health: major problems they are facing particularly in last one year, number of family members affected, number of days unable to work, visits to doctor, expenditure spent on medicines and total expenditure on health. Section six is about impacts on crops and details of the impact. Section seven is about impact on livestock. Section eight is about impact of mining on rural social structure.

1.11.1.3. Case study

Case study method was taken to understand the intensity of mining and respondents reaction towards it. During the endeavour single and multiple case studies were included as qualitative techniques to draw theoretical propositions.

1.11.1.4. Schedule

The household schedule was designed in such a way that it captured the details of socio-cultural and economic information of the residents of Ib valley coalfield. These include demographic details, educational status, occupational and income aspects of the project affected persons. This also helped in the collection of data regarding the pre and post land use patterns.

1.11.1.5. Focused Group Discussion

This form of qualitative research was adopted in which a group of people are asked about their perceptions, opinions, beliefs, and attitudes towards their economic interdependency, health condition, social and cultural ties etc. Researcher interacted with a group of people where the participants were free to talk with other group members.

1.12. Secondary Data Collection

Secondary data were collected from the journals, periodicals, books, published reports, census reports and from economic survey of Odisha and India. Quantitative information on production, productivity, costs, profit, and manpower at Ib valley were collected from MCL office of Ib valley and Lakhanpur area. Annual reports of MCL and data on coalfields of Odisha are collected from the official website of MCL. Besides this, other data on Indian coalfields were collected from the website of Coal India Limited, Ministry of Coal and from the website of Indian Bureau of Mines. Further, data on world coal scenario was collected from the websites of World Coal Association and World Coal Institute.

1.13. Methods of Data Analysis

Both qualitative and quantitative data were analysed on the basis of specific objectives of the study. Quantitative data was tabulated and statistically analysed by calculating the mean, standard deviation, percentage and frequency. Moreover, all these statistical calculation was done by employing SPSS software. Similarly, qualitative data was interpreted based on the information collected from the field by using qualitative data analysis techniques, such as case study.

In the present study, four major impacts of mining were included. They are: impact on social structure, livelihood, agriculture and health. While analysing the data some variables like gender, age, education, community, caste, land holding size, distance from active mining zone, livelihood, input and output of agriculture, and cost of illness were taken into consideration.

1.14. Thesis Structure

The present thesis is organized into eight chapters. The current chapter introduces itself with the problem under study. In this chapter, the intrinsic relationship between human being, nature and natural resources was discussed. Then the renewable and non-renewable natural resources and importance of mineral resources was discussed. Diversified impacts of mining and coal mining were also come across. This is followed by objectives, theoretical framework, methodology, sources of data and methods of data analysis.

The second chapter provides a detail profile of coal mining in India in general and Odisha in particular. It also narrates about MCL, a part of Coal India, its history and details. Third chapter provides a detailed description about coal mining at Ib valley coalfield, followed by an in-depth depiction about demographic details of the study area. It includes age, sex, marital status, occupation, education, land holding size and economic condition of both mining affected and control villages.

The fourth chapter provides an analysis on the impact of coal mining on rural social structure. Here the argument is totally based on the changes occurred in the sphere of family structure and function, marriage pattern, kinship relation, dowry system, caste system, traditional power structure, *Jajmani* system, observance of fairs and festivals and impact of mining on community life and social security.

The fifth chapter deals with the impacts of coal mining on rural livelihoods. In order to support our argument, livelihood was discussed by drawing a comparison between mining affected and control villages. This chapter encompasses the pre and post mining scenario and then the changes occurred in the sphere of five capitals with the help of sustainable livelihood framework prepared by DFID. Even the current situation of control villages was also discussed entirely.

Sixth chapter provides an analysis on the adverse effects of coal mining on the agricultural production of mining affected villages. To justify the argument, a comparison between pre and post mining scenario was made. Then the entire agricultural scenario was compared with the control villages.

The seventh chapter revolves around the reasons of health hazards and the socio-economic costs. It confers the issues associated with mining pollution, prevalence of

major health problems, frequency and types of diseases, health cost and the steps taken by MCL to eliminate these complications. And at last, chapter eight summarizes the entire finding of the study and gave concluding remarks.

Chapter-II
Mining Scenario in India

2.1. Mining Scenario in India

Minerals perpetuate as the pillar of cost-effective endowment for every nation of the world and India has been exceedingly bestowed with this bequest of nature. Numeral varieties of minerals having productive substances are awfully accessible in this country. Evidences illustrate that it also has been recognized as a global producer of chromite, coal, copper, iron ore, lead-zinc and bauxite since time immemorial. The most primitive and authentic source of information describes that the information regarding minerals in India originates from 'Arthasastra' which was unruffled by Kautilya, eminently recognized as Chanakya, between 321 and 296 B.C. This discourse provides an inclusive description vis-à-vis mineral and metals as well as their method of production. Even it contributed a detailed assessment on the fabrication of alloys such as brass, bronze, gold and silver. Besides this, Kautilys also pronounced the assets and credentials which a bureaucrat of mines necessarily reserves (Bagchi & Ghose, 1980; Singh, 1982).

During the medieval ages, India witnessed a moderately healthy metallurgical industry. Until, 1400 B.C.-1800 B.C., Indian mining industry was under the control of kings till the Mughals established some regulatory controls on minerals. Some of the princely states such as Rajasthan and Mysore continued their own process of mining and also had their own safety regulations up till then 18th century. On the other hand, the first evidence of mining in India dates back to 1774 when Mr. John Summer and Mr. S.G. Heatly of East India Company were allowed by the then Governor General of Bengal Mr. Warren Hestings to mine coal at Pachete and Birbhum. In the year of 1880, M/s John Taylor & Sons Ltd. started mining gold at the Kolar Gold Fields. For the first time in India oil was bored at Digboi in the year of 1866 (IBM, 2014a).

However, mining activities continued to be the most aboriginal aspect in India ever since the initial phase of modern era. Subsequently, with the evolution of industrial economy the demand for minerals slowly but surely roused. And after independence Indian mining industry has shown a tremendous growth under the influence of

successive Five Year Plans. Prior to independence it also ensures its share in the exploration of minerals like copper, iron ore, lead, zinc, bauxite etc. But the production of these minerals amplified all through the aftermath of 11th Five Year Plan (IBM, 2014b).

Mining sector of India is considered as an essential sector of Indian economy. Naturally, this country is endowed with both metallic and non-metallic minerals. India as a leading producer of 87 minerals produces 4 fuel, 10 metallic, 47 non-metallic, 3 atomic and 23 minor minerals. However, Indian mining industry is categorised by varied minor yet active mines. In India the number of reporting mines which are actively involved in the production of minerals was 3318 in 2014-15 as against 3772 in compare to the previous year. Of them, 498 mines are in operation in Rajasthan, 444 are in Andhra Pradesh followed by Gujarat (362), Madhya Pradesh (326), Tamil Nadu (272), Jharkhand (250), Chhattisgarh (201), Karnataka (178), Odisha (173), Maharashtra (150), Telangana (145) and West Bengal (120). Logically, these 12 states collectively construed for 94 percent of total number of mines in 2014-15. The numbers of reporting mines in India are given below:

Table No. 2.1: **Number of Reporting Mines in India**

Sector	**2009-10**	**2010-11**	**2011-12**	**2012-13**	**2013-14**	**2014-15**
Coal(including Lignite)	560	573	573	575	575	575
Metallic Minerals	701	719	633	708	663	595
Non-Metallic Minerals	1779	1827	2030	2695	2484	2148
All Minerals*	3040	3119	3236	3978	3722	3318
*Excluding atomic minerals, petroleum (crude), natural gas (utilized) and minor minerals						

Source: http://mines.nic.in/ViewData/index?mid=1385

Among all the minerals, during 2014-15, India occupied 3rd rank in the production of coal and lignite. Over the years, the growing demand for coal is continuously proving to be an essential input in the production sectors such as steel, cement, electricity, fertilizer, sponge iron etc. In order to fulfil the demand, both the public and private sector coal companies are putting their continuous effort to mine coal rampantly. Even a sharp increase was professed in the production of both coking and non-coking coal by the coal bearing states.

2.2. Coal Mining in India: The Past

Coal mining industry in India was started nearly 240 years ago. In the year of 1774, M/s Sumner and Heatly of East India Company grew the authorization of the then Governor General of Bengal Mr. Warren Hestings to mine coal in the Raniganj coalfield on the western bank of river Damodar. But this industry continued to be inactive till the introduction of steam locomotives in the year of 1853. However, with this intensification the annual production of Indian coal mining industry sprinkles to an annual average of 1 million tonnes (MT). By 1900 and 1920 it could able to produce 6.12 MTs and 18 MTs per year. The production touched a height of 29 million tonnes by 1942 and 30 million tonnes by 1946. On the other hand, after independence, the introduction of 5-year development plans offered a thump and it could be able to enhance the production up to 33 million tonnes during the 1st five year plan period. Keeping in view the growing demand for coal, the need for systematic and scientific development of coal industry was being felt. Hence in the year of 1956, National Coal development Corporation (NCDC) was formed. All through that era, the Singareni Collieries Company Ltd. (SCCL) which was in operation since 1945 turn into a government company beneath the control of Government of Andhra Pradesh, as a consequence India owned two Government coal companies during the fifties (Ministry of Coal, 2014a).

2.3. Nationalisation of Coal Mines

The origin of commercial coal mining in modern India has been inclined by the inevitability of domestic consumption of coal. Owing to the increasing demand of steel industry, significant attention has been given to the meticulous utilization of cooking coal reserves in Jharia coalfield. Throughout that phase, sufficient capital investment totackle the cumulative determination for energy requirements was not approachable by the private coal mine owners. The unscientific mining practices and poor working condition of the mine workers turn out to be an alarming ingredient for the government of India. By observing the full portrait of this discourse, the central government procured a resolution to nationalize the private coal mines. The nationalization was equipped in two phases, in the first phase it dealt with the coking coal mines in 1971-72 and then with the non-coking coal mines in 1973.

In October, 1971, the Coking Coal Mines (Emergency Provisions) Act, 1971 was empowered to captivate public interest for the supervision of coking coal mines and coke oven plants which impended for nationalization. This Act was driven away by Coking Coal Mines (Nationalization) Act, 1972 which not only nationalized the coking coal mines and coke oven plants but also embraced the Tata Iron and Steel Company Limited (TISCO) and Indian Iron and Steel Company Limited (IISCO), in to its fold of nationalization on 1st May 1972. Since then it was in progress underneath the Bharat Coking Coal Limited (BCCL). A different enactment i.e. the Coal Mines (Taking over of Management) Act, 1973, prolonged the emphasis on Government of India to occupy its position on the supervision of coking and non-coking coal mines in seven states. This has been monitored by the nationalization of all the mines on 1st May 1973 with the enactment of the Coal Mines (Nationalization) Act, 1973 which became the eligibility criteria to govern coal mining in India (Ministry of Coal, 2014b).

2.4. Formation of Coal Companies

With the enactment of Coking Coal Mines (Emergency Provisions) Ordinance by government of India on 16th October 1971, all coking coal mines except the captive mines of TISCO and IISCO came under the supervision of Government. To manage these taken over mines a whole new company named Bharat Coking Coal Limited (BCCL) was premeditated as a subsidiary of the Steel Authority of India Limited. After the formation of BCCL, the occupied mines were nationalized on 1st May 1972. Then the administration of 711 coal mines was also occupied by the Government on 31st January 1973 and they came under the shadow of nationalization on 1st May 1973. In order to supervise the non-coking coal mines, again a government company called the Coal Mines Authority Limited (CMAL) was formed in the same year having its head quarter at Calcutta. The CMAL was structured with four divisions i.e. the Central Division, the Eastern Division, the Western Division and the Central Mine Planning and Design Institute Limited (CMPDIL). After the formation of CMAL all the former mines of National Coal Development Corporation came under its regulation.

In September 1975, Coal India Limited (CIL) was designed with having five subsidiaries viz. Bharat Coking Coal Limited (BCCL), Central Coal Fields Limited

(CCL), Eastern Coalfields Limited (ECL), Western Coalfields Limited (WCL) and Central Mine Planning and Design Institute Limited (CMPDIL). By considering the intensification of production, investment, geographical spread of administrative set up, technical and communication problems etc. of CCL and WCL, two more coal companies i.e. Northern Coalfields Limited and Southern Coalfields Limited were moulded on 28th November 1985. While making an allowance for the coalfields of Odisha, the Mahanadi Coalfields Limited (MCL) was introduced on 3rd April 1992 with its headquarters at Jagruti Vihar Sambalpur (Odisha). It was formed as a subsidiary of Coal India Limited (CIL) to cope with Talcher and IB Valley Coalfields in Odisha.

Currently, Coal India Limited (CIL) is operating in 8 subsidiaries viz. Bharat Coking Coal Limited (BCCL), Central Coalfields Limited (CCL), Eastern Coalfields Limited (ECL), Western Coalfields Limited (WCL), South Eastern Coalfields Limited (SECL), Northern Coalfields Limited (NCL), Mahanadi Coalfields Limited (MCL) and Central Mine Planning and Design Institute Limited (CMPDIL). While the first seven subsidiaries are dealing with the production and management of coal, CMPDIL was established to formulate the perspective plan(s), adaptation of consultancy services and investigation of coal resources in the country to prepare detailed information regarding the authenticity of mining projects. CIL and its subsidiaries are fully Central Government owned company which was merged in to the Companies Act in the year of 1956. But the coal mines of Assam and its adjacent zones are under the direct control of CIL's division of North Eastern Coalfields. It also has a public sector coal company i.e. Singareni Collieries Company Limited (SCCL) which is a joint venture among Government of Andhra Pradesh and Government of India.

Table No. 2.2: CIL's Subsidiaries

Sl. No.	Name of the Subsidiary	Year of Formation	Headquarters
1.	BCCL	1973	Dhanbad
2.	ECL	1975	Sanctoria
3.	CCL	1975	Ranchi
4.	WCL	1975	Nagpur
5.	CMPDIL	1975	Ranchi
6.	NCL	1986	Singrauli
7.	SECL	1986	Bilaspur
8.	MCL	1992	Sambalpur

Source: www.coalindia.in

2.5. Coal Reserve in India

The coal resources of India are obtainable from two regions i.e. Gondwana formations of peninsular India and Tertiary formations of north-eastern region. On the basis of regional/promotional exploration, when the boreholes reserve establish at the distance between 1-2 Km, the resources are categorised into 'Indicated' or 'Inferred' category. In addition to this, when the boreholes establish not less than 400 meter, the resources are called as more reliable and it comes under 'Proved' category. On the basis of its formation and category, the coal resources of India as on 1.04.2014 can be categorised into:

Table No. 2.3: Categorization of Coal resources in India

(In Million Tonnes)

Formation	Proved	Indicated	Inferred	Total
Gondwana Coals	125314	142286	32348	300068
Tertiary Coals	594	104	800	1496
Total	125971	142390	33149	301564

Source: Annual Report, Ministry of Coal, 2014-15.

The exploration of coal in India is being taking place up to the extreme gravity of 1200m by the GSI, CMPDI, SCCL and MECL etc. According to the recent estimation (1st April 2014) of Geological Resources of Coal, it has been report that a cumulative total of 301.56 billion tonnes of coal are in existence in the coal regions of Gondwana and Tertiary Coalfields.

Table No. 2.4: Status of Coal in Gondwana Coalfields

State	**Geological Resources of Coal (in Million Tonnes)**			
	Proved	**Indicated**	**Inferred**	**Total**
Andhra Pradesh	9729	9670	3068	22468
Bihar	0	0	160	160
Chhattisgarh	16052	33253	3228	52533
Jharkhand	41377	32780	6559	80716
Madhya Pradesh	10411	12382	2879	25673
Maharashtra	5667	3186	2110	10964
Odisha	27791	37873	9408	75073
Sikkim	0	58	43	101
Uttar Pradesh	884	178	0	1062
West Bengal	13403	13022	4893	31318
Total	125314	142286	32348	300068

Source: Annual Report, Ministry of Coal, 2014-15.

Table No. 2.5: Status of Coal in Tertiary Coalfields

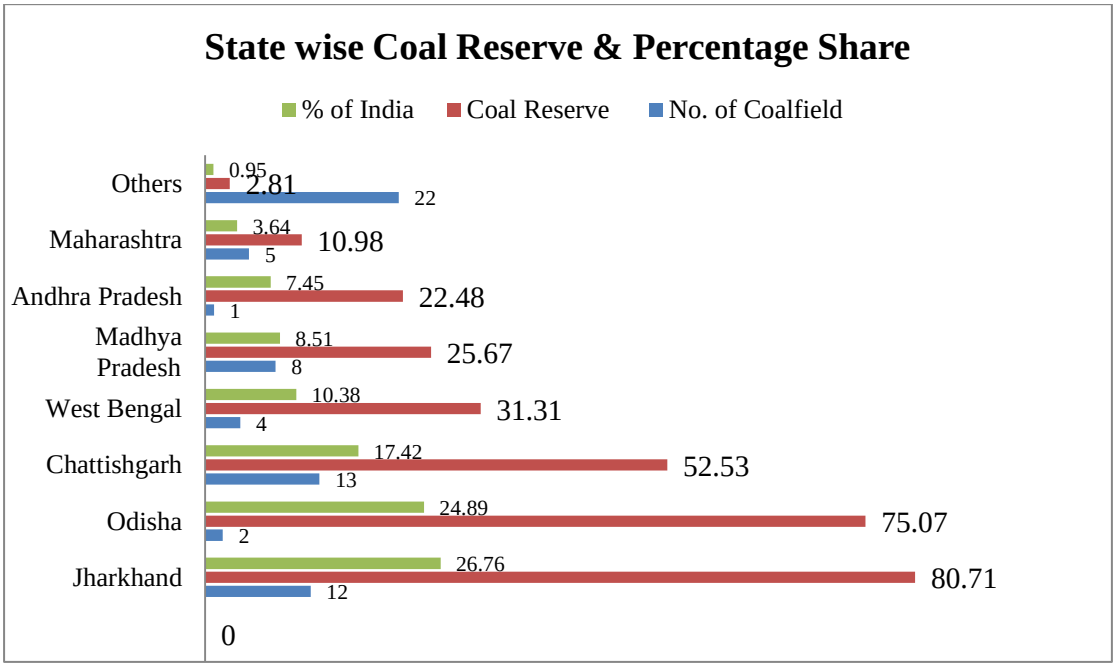
State	Geological Resources of Coal (in Million Tonnes)			
	Proved	**Indicated**	**Inferred**	**Total**
Arunachal Pradesh	31	40	19	90
Assam	465	47	3	515
Meghalaya	89	17	471	576
Nagaland	9	0	307	315
Total	594	104	800	1496

Source: Annual Report, Ministry of Coal, 2014-15.

2.6. State Wise Share of Coal Reserve

Periodically, the eastern states of India i.e. Jharkhand, Odisha, Chhattishgarh and West Bengal are endowed with 79.45 percent of coal reserves. While Jharkhand has occupied the first position by reserving 80.71 billion tonnes of coal, Odisha holds the second position by preserving 75.07 billion tonnes followed by Chhattishgarh i.e. 52.53 billion tonnes. Figure No. 2.1 is clearly depicting the state wise reporting mines, coal reserve scenario and their percentage share in India.

Figure No. 2.1: State Wise Share of Coal Reserve (Billion Tonnes)



Source: http://www.mcl.gov.in/Others/ecoalfields.php

Map 2.1: Coal Reserves in India

Source: *www.mapsofindia.com*

For the duration of 1950-51, the production of coal was only 32.30 million tonnes. It amplified reasonably during the anticipation of 1970-71 (72.95 million tonnes). But the production of coal indicated a tremendous growth during the period of 1980-81 to 1999-2000. During 1980-81, the production of both coking (metallurgical/non-metallurgical) and non-coking coal was 113.91 million tonnes and by 1989-90, the production crossed the boundary of 200 million tonnes. The production was almost stagnant between the period of late sixties and early seventies. But the emphasis on opencast mines as well as the nationalization of coal mines during the early seventies turned out to be the means of production. At the end of nineties the production grasped the level of 300 million tonnes by employing additional help from modern technologies. Since the early part of twenties till yet the production is proving its excellence as in 2013-14 the production was 565.8 million tonnes. However, the estimated production during 2014-15 is 426.7 million tonnes (provisional). The details of the production from 1951-2015 are given below:

Table No. 2.6: Production of Coal during 1951-2015
(In Million Tonnes)

Year	Coking Coal		Non-coking Coal	Total
	Metallurgical	Non-metallurgical		
1950-51	na	na	na	32.30
1960-61	16.99	na	38.24	na
1970-71	17.82	na	55.13	na
1980-81	24.59	8.03	81.29	113.91
1981-82	26.89	9.23	88.11	124.23
1982-83	30.10	7.47	92.93	130.50
1983-84	30.11	6.24	101.87	138.22
1984-85	30.57	6.04	110.80	147.41
1985-86	29.07	6.57	118.56	154.20
1986-87	27.91	11.63	126.23	165.77
1987-88	26.28	14.73	138.71	179.72
1988-89	25.16	17.56	151.88	194.60
1989-90	24.50	19.93	156.46	200.89
1990-91	24.10	21.20	166.43	211.73
1991-92	26.33	19.95	183.00	229.28
1992-93	25.72	19.64	192.90	238.26
1993-94	25.99	19.07	200.98	246.04
1994-95	24.54	19.71	209.55	253.80
1995-96	23.53	16.57	230.03	270.13
1996-97	22.64	17.90	245.12	285.66
1997-98	24.16	19.34	252.43	295.93
1998-99	23.82	15.36	253.09	292.27

1999-2000	21.23	12.02	266.72	299.97
2000-01	19.31	11.77	278.55	309.63
2001-02[a]	17.96	10.71	299.12	327.79
2002-03[a]	18.35	11.84	311.08	341.29
2003-04	18.27	11.13	331.85	361.25
2004-05	18.19	12.03	352.39	382.61
2005-06	16.97	14.54	375.53	407.04
2006-07	17.23	14.87	398.74	430.83
2007-08	18.07	16.39	422.63	457.08
2008-09	17.30	17.51	457.95	492.76
2009-10	17.73	26.68	487.63	532.04
2010-11	17.70	31.85	483.15	532.69
2011-12	16.20	35.46	488.3	540.0
2012-13	14.6	37.0	504.8	556.4
2013-14	9.7	47.1	509.0	565.8
2014-15[*]	---	---	---	426.7

Source: http://indiabudget.nic.in/es2014-15/estat1.pdf

Note: na: not available, [a]: including Meghalaya coal, [*]: up to December 2014

Coal India Limited and its subsidiaries are the key components of coal production in India. During April-December 2014, 342.37 million tonnes of coal was produced by Coal India and its subsidiaries as against the annual target of 507 million tonnes. But during 2013-14, it produced 458.60 million tonnes of coal in compare to 2012-13 when the production was 452.21 million tonnes. So it showed a straight growth of 6.39 million tonne in compare to the previous year. It is worth to mention that, over the years the production of coal is increasing mostly by employing modern means and apparatus of mining. Among all the subsidiaries of CIL, SECL is producing maximum amount of coal both by opencast and underground mines. On the other hand, BCCL which is operating from Dhanbad is producing lowest amount of coal.

Singareni Collieries Company Limited, which embraces all the coal producing regions of south, produced 53.10 million tonnes and 52.19 million tonnes during the period of 2013-14 and 2012-13 respectively. TISCO, IISCO and DVC also had their share in the production of coal during the above mentioned time period. The details about production of coal (from 2009-10 to 2014-15) by Coal India Limited and its subsidiaries are given in the Table No. 2.7.

Table No. 2.7: Subsidiary wise Coal Production

Company	2009-10 (Actual)	2010-11 (Actual)	2011-12 (Actual)	2012-13 (Actual)	2013-14 (Actual)	2014-15 (Target)	2014-15 (Actual) (up to December,2014)
ECL	30.06	30.81	30.56	33.91	36.05	38.00	26.73
BCCL	**27.51**	**29.00**	**30.21**	**31.21**	**32.61**	**34.00**	**24.57**
CCL	47.08	47.52	48.00	48.06	50.02	55.00	36.49
NCL	67.67	66.25	66.40	70.02	68.64	77.00	48.38
WCL	45.74	43.65	43.11	42.29	39.73	44.00	28.62
SECL	**108.01**	**112.71**	**113.84**	**118.22**	**124.26**	**131.00**	**90.18**
MCL	104.08	100.28	103.12	107.89	110.44	127.00	87.11
NEC	1.11	1.10	0.60	0.61	0.66	1.00	0.30
CIL	**431.26**	**431.32**	**435.84**	**452.21**	**462.41**	**507.00**	**342.37**
SCCL	50.43	51.33	52.21	53.19	53.10	55.00	35.24
Others	50.35	50.04	51.90	51.00	NA	68.25	49.10
Total	532.04	532.69	539.95	556.40	511.70	630.25	426.71

Source: Annual Report, Ministry of Coal 2014-15

2.7. Production of Coal by Grades & Sectors

During 2013-14, the total production of coal in India touched the height of 565.766 million tonnes which recorded the upsurge of 1.7 percent in compare to the last year. Throughout the year coal mining was mainly confined to the public sector which produced both coking and non-coking coal. But the non-coking coal was dominated the scenario in compare to coking coal. Even the private sector mining bodies were actively produced non-coking coal rather than coking coal (Table No. 2.8).

Table No. 2.8: Sector wise Production of Coal in India

Category	Coal Production (2013-14)		
	Coking	Non-coking	Total
Total Public	49.503	478.578	528.081
Total Private	7.315	30.370	37.685
All India	56.818	508.948	565.766

Source: Annual Plan, Ministry of Coal 2013-14, Coal Controller's Organisation

Among the public sector category, CIL was the leading producer of both coking and non-coking coal. While CIL produced 462.413 million tonnes of coal which holds the lion share of 81.73 percent, SCCL has its share of 8.92 percent. In addition to this, the production of private sector was 6.66 percent. Within CIL, the major contributors such as SECL, MCL and NCL contributed 21.96 percent, 19.52 percent and 12.13

percent respectively. These three groups jointly subsidized 53.51 percent of total coal production at national level and 65.59 percent within CIL. As it has already been mentioned in the table-2.7 regarding the actual production of coal by CIL, it is needless to indicate that, all the 8 subsidiaries of it are the active adherents of non-coking coal production. Whereas, BCCL is the prime producer (30.05 million tonnes) of coking coal, the representation of NCL, MCL & NEC was completely inattentive (Ministry of Coal, 2014a).

2.8. Production from Underground & Opencast Mines

In India, coal mining is taking place by employing opencast and underground techniques. While opencast mining takes the credit of producing 90% of total production, around 10% arises from underground mining. During 2014-15, the production of raw coal from Open cast mines was 92.9 percent of total raw coal production. Whereas the production of coal from Underground mines during 2014-15 is 35.047 million tonnes, it accounts only 7.09 percent of total production. Company wise production of coal is given below:

Table No. 2.9: Company wise Production of Coal (Apr-Mar, 2014-15)
(From Underground & Opencast Mines)

Company	Underground Production	Opencast Production	Total Production
	2014-15	2014-15	2014-15
ECL	7.296	32.712	40.008
BCCL	2.029	32.485	34.514
CCL	0.814	54.811	55.652
NCL	0.000	72.484	72.484
WCL	7.566	33.581	41.147
SECL	16.036	112.239	128.275
MCL	1.276	120.103	121.379
NEC	0.003	0.776	0.779
CIL	**35.047**	**459.191**	**494.238**

Source: *https://www.coalindia.in/en-us/performance/physical.aspx*

2.9. Productivity of Coal (OMS)

Out of 559 operating coal mines in India, 209 were opencast and 323 were underground mines. The left out 27 mines are mixed mines. Again there are 532

public sector mines and 27 private sector mines. Productivity of coal mines is measured by output per man shift (OMS) per tonnes. However, the output per man shift (OMS) during 2013-14 enhanced to 5.62 tonnes per man shift as compared to the previous year which witnessed 5.32 tonnes. The increase of productivity is mainly arises from the opencast mines while productivity of underground mines is more or less stagnant. Because of this reason the drive towards the production of opencast mines is gaining its stand. During 2012-13 and 2013-14, the OMS of underground mines were 0.77 and 0.76 tonnes respectively. But at the same time the OMS of opencast mines during the same time period was 11.48 and 12.18 tonnes respectively. The overall OMS of Coal India Limited during 2012-13 and 2013-14 was 5.32 and 5.62 tonnes respectively.

Table No. 2.10: Productivity: Output per Man Shift (Oms)

Company	Underground OMS		Opencast OMS		Overall OMS	
	2012-13	2013-14	2012-13	2013-14	2012-13	2013-14
ECL	0.46	0.48	10.17	10.96	1.94	2.13
BCCL	0.35	0.31	8.31	9.38	2.50	2.74
CCL	0.33	0.33	6.09	6.26	4.42	4.64
NCL	0.00	0.00	13.65	13.78	13.65	13.78
WCL	1.10	1.07	5.03	5.14	2.97	2.96
SECL	1.37	1.35	19.26	21.45	6.72	7.23
MCL	0.97	0.84	21.34	22.16	16.07	16.69
NEC	0.01	0.01	3.77	4.33	1.30	1.54
CIL	**0.77**	**0.76**	**11.48**	**12.18**	**5.32**	**5.62**

Source: CIL's Annual Report & Accounts 2013–14

2.10. Despatch &off-take of Coal

Despatches of raw coal during 2013-14 were higher than that of the previous year. During 2013-14, the despatch of raw coal touched the height of 572.060 million tonnes which was around 0.87 percent higher than previous year's production. However, CIL was the leading despatcher of coal which accounted around 82.32 percent of raw coal in India. While SCCL has its contribution of 8.37 percent, the private sectors contributed nearly 6.66 percent. Among the subsidiaries of CIL, the central contributors were SECL, MCL, and NCL having their aid of 21.31 percent, 19.97 percent and 12.56 percent respectively. Then again, the collective despatch of raw coal by CIL was 53.84 percent. On the other hand, the offtake of coal was nearly

same and a minimal difference was found in this regard (Ministry of Coal, 2014). The detailed information regarding despatch and offtake of raw coal is given below:

Table No. 2.11: Despatch & Offtake of Raw Coal in India (2013-14)

Company	Raw Coal	
	Despatch	Offtake
ECL	35.974	36.250
BCCL	34.048	34.128
CCL	52.121	52.124
NCL	71.892	71.892
WCL	39.939	39.945
SECL	122.013	122.027
MCL	114.342	114.347
NEC	0.577	0.577
CIL	**470.916**	**471.290**
SCCL	47.892	47.942
Other Public	15.145	15.143
Total Public	**533.951**	**534.375**
Total Private	**38.109**	**38.110**
ALL INDIA	**572.060**	**572.485**

Source: Annual Plan, Ministry of Coal 2013-14, Coal Controller's Organisation

Next to raw coal, India has also its share of despatching washed coal. Though the subsidiaries of CIL are playing dominant role in despatching washed coal, the private sectors are also playing prominent role in despatching the same. During 2013-14, while the public sectors despatched nearly 14.296 million tonnes of washed coal, the private sectors despatched 7.803 million tonnes. The offtake of washed coal during this period was almost equal with despatch category. The details regarding despatch and offtake of washed coal are given below:

Table No. 2.12: Despatch & Offtake of Washed Coal in India (2013-14)

Company	Washed Coal	
	Despatch	Offtake
BCCL	0.977	0.977
CCL	8.060	8.060
NCL	3.779	3.779
WCL	0.118	0.118
CIL	**12.934**	**12.934**
IISCO	0.409	0.409
Total Public	**14.296**	**14.296**
Total Private	**7.803**	**7.803**
ALL INDIA	**22.099**	**22.099**

Source: Annual Plan, Ministry of Coal 2013-14, Coal Controller's Organisation

Out of the total despatches of coal, a substantial segment of coal was despatched to the power sector followed by cement, steel and fertilizer sectors. During 2013-14, CIL was able to despatch 96.1 percent of coal as against 490.54 million tonnes. Although the actual target was not fulfilled, but it managed to despatch more (5.27 million tonnes) in compare to the last year. The total sector wise despatch scenario is given below:

Table No. 2.13: Sector wise Despatch of Coal, 2012-13 & 2013-14

Year	**2013-14**			**2012-13**	**Growth over Last Year**	
Sector	Target	Despatch	% Against Target	Actual	Abs.	% Share
Power (Utility)	376.18	353.83	94.1	345.43	8.40	2.4
Steel*	4.72	3.66	77.5	4.74	-1.08	-22.8
Cement**	7.08	5.45	77.0	6.47	-1.02	-15.8
Fertilizer	2.84	2.29	80.6	2.50	-0.21	-8.4
Others	99.72	106.25	106.5	107.07	-0.82	-0.8
Despatch	490.54	471.48	96.1	466.21	5.27	1.1

Source: CIL's Annual Report & Accounts 2013–14

Note: *Despatch of washed coking coal and raw coking coal for direct feed, blendable coal to steel plants and to external washeries.
**Despatch to cement plants excluding cement cpp.

The above table shows that in compare to last year, during 2013-14 the sector wise despatch of coal was more in power and fertilizer sector. But the despatch of coal in steel and cement sector was more all through the last year.

2.11. Manpower of CIL

According to the 2013-14 annual report of Ministry of Coal, Coal India Ltd. is employing 3,46,638 employees in its subsidiaries and also in its headquarters. By 31st March 2013, the total man power of Coal India Ltd. (CIL) and its subsidiaries was 3, 57,926. So the above data revealed that a sharp decline (i.e. 11,288) of man power has happened within a year. Because of the rapid use of modern technologies in opencast mines man power is getting affected per year. The subsidiary wise man power of CIL is given below:

Table No. 2.14: Man Power of CIL & its Subsidiaries

Company	2010-11 (As on 31.03.2011)	2011-12 (As on 31.03.2012)	2012-13 (As on 31.03.2013)	2013-14 (As on 31.03.2014)
ECL	81,128	78,009	74,276	71826
BCCL	67,934	64,884	61,698	58,960
CCL	52,285	50,026	48,126	46,686
WCL	59,034	56,989	54,960	52,484
SECL	78,009	76,078	73,718	70,910
MCL	21,425	22,023	22,065	22,278
NCL	16,209	16,329	16,073	16,741
NEC	2,622	2,538	2,376	2,199
CMPDIL	3,102	3,129	3142	3135
DCC	582	562	551	512
CIL(HQ)	1,008	979	941	907
TOTAL	**3,97,138**	**3,71,546**	**357926**	**346638**

Source: CIL's Annual Report & Accounts 2012-13 & 2013–14

2.12. Import of Coal

As per the existing import policy, coal can be generously imported (under Open General Licence) by the consumers on the basis of their commercial practicality. Steel Authority of India and other steel manufacturing entities are actually importing coal to meet the prerequisite of demand. On the other hand the power plants, cement plants, captive power plants, sponge iron plants, industrial consumers and coal traders etc. are the continuous units of importing non-coking coal. The pig-iron manufacturers and iron and steel sector consumers are importing coke via mini-blast furnace. The details about import of coal and its products i.e. coke is given below:

Table No. 2.15: **Import of Coal**
(During last five Years)
(In million Tonnes)

Type of coal	**2009-10**	**2010-11**	**2011-12**	**2012-13**	**2013-14**	**2014-15**
Coking Coal	24.69	19.48	31.80	32.56	37.19	10.87
Non-Coking Coal	48.56	49.43	71.05	105.00	131.25	38.59
Coke	2.35	1.49	2.36	3.07	4.19	1.17
Total import	75.60	70.40	105.21	140.63	168.44	49.45*
*Import up to June 2014						

Source: http://coal.nic.in/content/production-supplies

2.13. Mining in Odisha

The state of Odisha is situated on the eastern seaboard of peninsular India. It encompasses 1, 55,707 sq. km. of land mass with 30 districts and the total population of 36.71 million people. According to the Economic Survey of Odisha during 2014-15, the service sector was witnessed around 51.2 percent of the Gross State Domestic Product (GSDP) followed by industry (33.4 percent) and agriculture (15.4 percent). However, the high growth rates during 10^{th} and 11^{th} Five Year Plans were documented by the industry and service sector. During the first four years of 11^{th} Five Year Plan the growth rate of industrial sector was 9.12 percent. The industrial sector includes manufacturing, mining and quarrying and electricity-gas-water supply. But most of the large scale industries in Odisha are mineral oriented (OES, 2015a).

Mineral resources are considered as the prime prosperity of Odisha. The state has been extraordinarily amplified with an array of rich mineral resources like bauxite, china clay, chromite, coal, dolomite, fireclay, graphite, gemstones, iron ore, limestone, manganese ore, mineral sand, nickel ore, quartz and quartzite and many more. The richness of these mineral reserves is proving to be beneficial for the industrial development of the state. However, the mining and quarrying sector is not only helping for the growth of GSDP but it also has its credit of generating massive amount of both direct and indirect employment (OES, 2015b).

2.13.1. History of Mining in Odisha

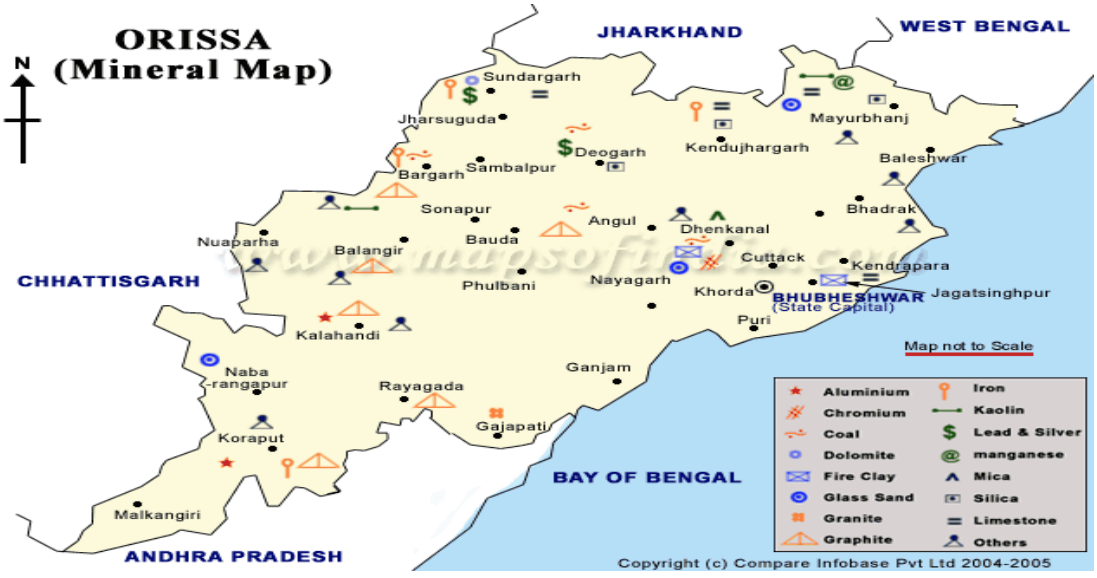
In Odisha, mining was in practice since the antique eras. But modern mining was started in the course of 1909 at the Rampur area of IB valley. The TISCO iron ore mine at Gorumohisani and Manganese mine at Goriajhar was started in the year of 1910. The excavations of dolomite and limestone mines were started in the year of 1914 at Panposh and Bisra respectively. Chromite mine at Baula area was started in 1942. After independence the mining sectors steered an eye-catching growth till the early part of eighties. During that period Sundargarh and Keonjhar districts get empowered to produce iron and manganese ore extensively. The formation of ferroalloy industries gave the boost to mine chromite at the Baula and Sukunda area of the state. During the early eighties i.e. in 1984, bauxite mining was started at Panchpatmali hills of Koraput district. Beach sand mining at the coastal belt of

Gopalpur, lead ore mining at Sundargarh and tin ore mining at Koraput was initiated during 1980's. In between 1985-2000, bauxite production by NALCO in Koraput and coal production by MCL in Ib valley and Talcher area was augmented. Besides these mines various small scale mines like graphite, fire clay, china clay, gemstones, morrum, quartz etc. were mushroomed in many parts of the state (Department of Forest & Environment, 2006).

2.13.2. Mineral Reserve in Odisha

The state of Odisha is canvased with infinite mineral reserves. In the mineral map it inhabits a conspicuous habitation both in terms of deposits and production. Noticeable reserves of chromite, iron-ore, bauxite, coal and some additional minerals like limestone, nickel, granite, dolomite tin, gemstone, graphite etc. are too accessible in the state. Among the mineral reserves of the state, coal constitutes the lion's share (86.48 percent) followed by iron ore (6.61 percent) and bauxite (2.16 percent). It also has 93 percent of India's chromite and nickel reserves, 52 percent of bauxite, 44 percent of manganese, 33 percent of iron ore and 24 percent of coal reserves. Even some of these minerals managed to project themselves in the world's mineral map. According to the Economic Survey of Odisha, 2014-15, it has been documented that the mining and quarrying subsector is subsidizing approximately 6.3 percent in the direction of Odisha's actual GSDP at 2004-05 prices (OES, 2015c).

Map 2.2: Mineral Map of Odisha



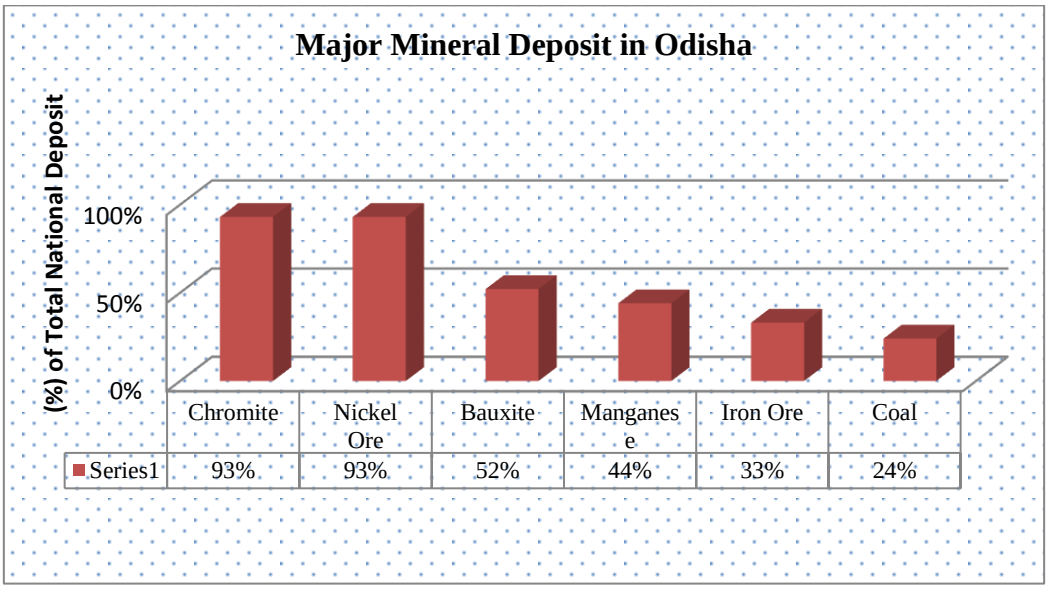
Source: ***www.mapsofindia.com***

Table No. 2.16: Mineral Reserves in Odisha
(By the end of 2013-14)

Minerals/Ores	Total Reserve (in million tons)	% of total State Reserve of All Minerals
1	2	3
Bauxite	1878.808	2.16
China Clay	280.912	0.32
Chromite	176.749	0.20
Coal	75073.000	86.48
Dolomite	676.348	0.78
Fire Clay	170.076	0.20
Graphite	8.608	0.01
Iron Ore	5737.142	6.61
Lead & Zinc Ore (Base Metal)	13.48	0.02
Lime Stone	1768.509	2.04
Manganese Ore	190.350	0.22
Heavy Minerals	226.00	0.26
Nickel Ore	219.67	0.25
Pyrophy lite	12.267	0.01
Mineral Sand	240.341	0.28
Vanadium Ore	6.48	0.01
Quartz & Silica Sand	134.341	0.15
Tin Ore (tons)	0.0155	0.00
Total	86813.1325	100.00

Source: Economic Survey of Odisha, 2014-15.

Figure 2.2: Major Mineral Deposit in Odisha & its Share in India



Source: Economic Survey of Odisha, 2014-15.

In the year 1956, the Odisha Mining Corporation Limited (OMC) was established as a public sector unit to monitor the mining sector in Odisha. As of now OMC is the largest state public sector unit of India's mining sector (OES, 2015c). But it is absolutely state owned. In India both the Central and State Government are regulating the mines and minerals. According to the Mines and Minerals Regulation & Development Act of 1957, it has been declared that the schedule I will be governed by the Central Government. Though coal is listed in this schedule, all the developmental activities of it are being dignified by the central government. The coalmines of Odisha are schematised by Mahanadi Coalfields Limited (MCL) which is a subsidiary of Coal India Limited (CIL). MCL is spreading over two coalfields i.e. Talcher Coalfield and Ib valley coalfield.

2.13.3. Coal mining in Odisha

In India, the eastern and south central states i.e. Jharkhand, Chhattisgarh, Odisha, West Bengal, Andhra Pradesh, Maharashtra and Madhya Pradesh are predominantly constitute more than 99 percent of the total coal reserves in the country. According to the Geological Survey of India (GSI) by 1st April 2014, the total coal reserve (Gondwana+Tertiary Coalfields) in India was approximately 301.56 billion tonnes. However, the coalfields of Odisha have covered around 7.6 percent area which accounts nearly 2723 Sq. Km. Subsequently, the state of Odisha comes under the Gondawana coalfields. Out of 47 Gondawana & 14 Tertiary coalfields, Odisha has its share of only two coalfields i.e. Talcher coalfield &Ib valley coalfield. While the coalfield of Talcher is producing 50.874 (67.77 percent) billion tonnes of coal, on the other hand, the coalfield of Ib valley is generating 24.198 (32.23 percent) billion tonnes of coal per year (MCL, 2015).

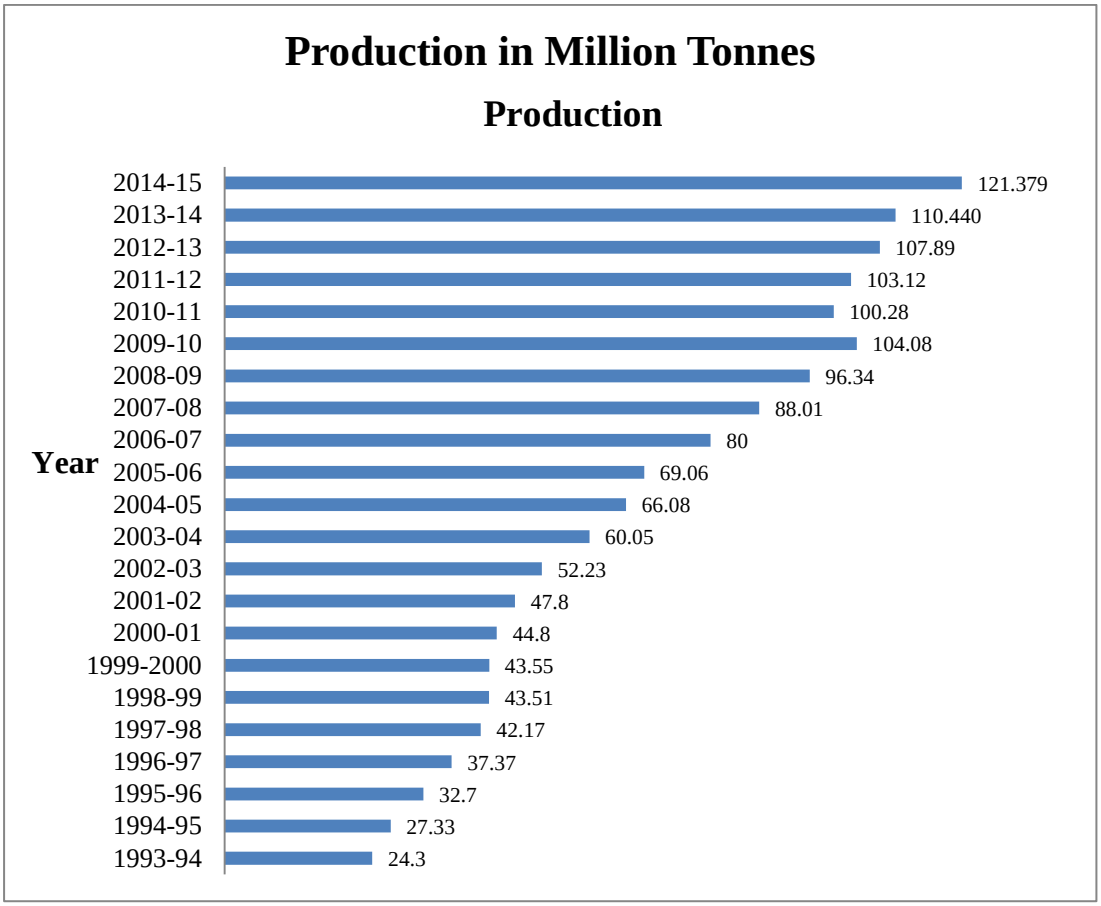
Talcher coalfield was in operation since 1937. It was first discovered at Gopalprasad. Then the Lateron GSI surveyed the mines in the year of 1955 and in 1921 Handidhua Colliery was established in the Talcher Town by M/s Villiers Ltd. After that NCDC was able to open up the mines at south Belanda, Nandira and Jagannath in the year of 1960, 1962 and 1972 respectively. Subsequently, after the establishment of CIL all the mines were under the control of CCL and SECL. But after the formation of MCL all the coal mines of Odisha came under its jurisdiction on 1992. It has six areas i.e.

Jagannath Area, Talcher Area, Hingula Area, Lingaraj Area, Bharatpur Area and Kaniha Area. On the other hand IB valley coalfield is spreading over Jharsuguda & Sundargarh districts of Odisha.

2.13.4. Production of Coal by Mahanadi Coalfields Limited

Mahanadi Coalfields Limited was achieved the status of 'Mini-Ratna' by Government of India on 15th March 2007. During the period of 2014-15 it has been enumerated as the 2nd largest dry fuel producer and supplier of Coal India Limited (CIL). In 2009, it reckoned as a proud member in the house of 100 Million Tonnes Coal Producing Companies. During the period of 2014-15it ended up by producing 121.379 million tonnes of coal.

Figure 2.3: Production of Coal by MCL



Source: http://www.mcl.gov.in/About/eproduction.php

By introducing mechanization and new technologies within the period of just 22 years MCL has achieved many milestones. The production of coal by opencast mines has positive impact for the growth of this company. During the period of last five years the targeted production was not achieved due to the reasons like environment/forestry

clearance, improper utilisation of R & R policy and land clearance. During 2012-13 and 2013-14, the actual target of opencast mines of MCL was 109.55 and 118.00 million tonnes respectively. But due to the above mentioned reasons it failed to achieve the targeted status and could be able to assimilate 106.22 and 109.01 million tonnes respectively. Likewise the production of coal from underground mines during 2012-13 and 2013-14 was 2.45 and 2.00 million tonnes respectively. But it achieved 1.68 and 1.43 million tonnes against its target.

2.13.5. Productivity of Coal by MCL

It has already been discussed that productivity of coal mines is measured by output per man shift (OMS) per tonnes. Conversely, the output per man shift (OMS) of MCL during 2013-14 enhanced to 3.86 percent in compare to previous year. The increase of productivity is mainly arises from the opencast mines while productivity in underground mines is more or less stagnant. Because of this reason the drive towards the production of opencast mines is gaining its stand. During 2012-13 and 2013-14, the OMS of underground mines were 0.97 and 0.84 tonnes respectively. But at the same time the OMS of opencast mines during the same time period was 21.31 and 22.16 tonnes respectively. The overall OMS of Coal India Limited during 2012-13 and 2013-14 was 5.32 and 5.62 tonnes respectively. On the other hand, the overall OMS of MCL during 2012-13 and 2013-14 was 16.07 and 16.69 tonnes respectively.

2.13.6. Consumers of MCL

The core coal consuming units of MCL are power plants, captive power plants, steel, cement, paper, aluminium and fertilizer industries. Among the non-core units it has 18 consumers. Of them Birla Tyres, OCL India Limited, Orissa Polyfibres, Tata Refractories Limited, Mangalam Timber Products Limited and Manishri Refractories & Ceramic Pvt Ltd are the chief consumers of MCL. Sector wise off take of coal is given below. Out of its total production in 2013-14, power sector including the captive power plants consumes around 79.75 percent coal.

Table No. 2.17: Sector wise Offtake of Coal
(In Million Tonnes)

Sector / Year	Power (Incl. CPP)	Cement	Others	Colliery Consumption	Total
2005-06	60.021	0.319	7.873	0.005	68.215
2006-07	63.152	0.160	13.109	0.005	76.426
2007-08	69.080	0.188	14.360	0.005	83.633
2008-09	69.466	0.175	21.643	0.005	91.289
2009-10	70.884	0.266	26.998	0.005	98.152
2010-11	74.707	0.266	27.11	0.005	102.088
2011-12	77.108	0.233	25.181	0.005	102.527
2012-13	88.160	0.384	23.451	0.005	111.946
2013-14	91.201	0.34	22.801	0.005	114.347

Source: http://www.mcl.gov.in/About/eofftake.php

MCL is also taking eventual attention for the dispatch of coal to cater the consumer satisfaction. Because of this reason, MCL is dispatching 100% sized coal to all its consumers. It is supplying coal both by road and rail. With the help of sophisticated equipment like Auto Electronic Bomb Calorie Meter, within two hours it is able to determine the grade of coal.

2.13.7. Manpower of MCL

According to the 2014-15 annual report, MCL is engaging 22,259 employees in its two coalfields. By 1st April 2014, the total man power of MCL was 22,272. But it revealed a decline i.e. 13by 1st April 2015.Because of the rapid expansion of opencast mines man power is getting affected per year.The department wise man power of MCL is given below:

Table No. 2.18: Manpower of MCL

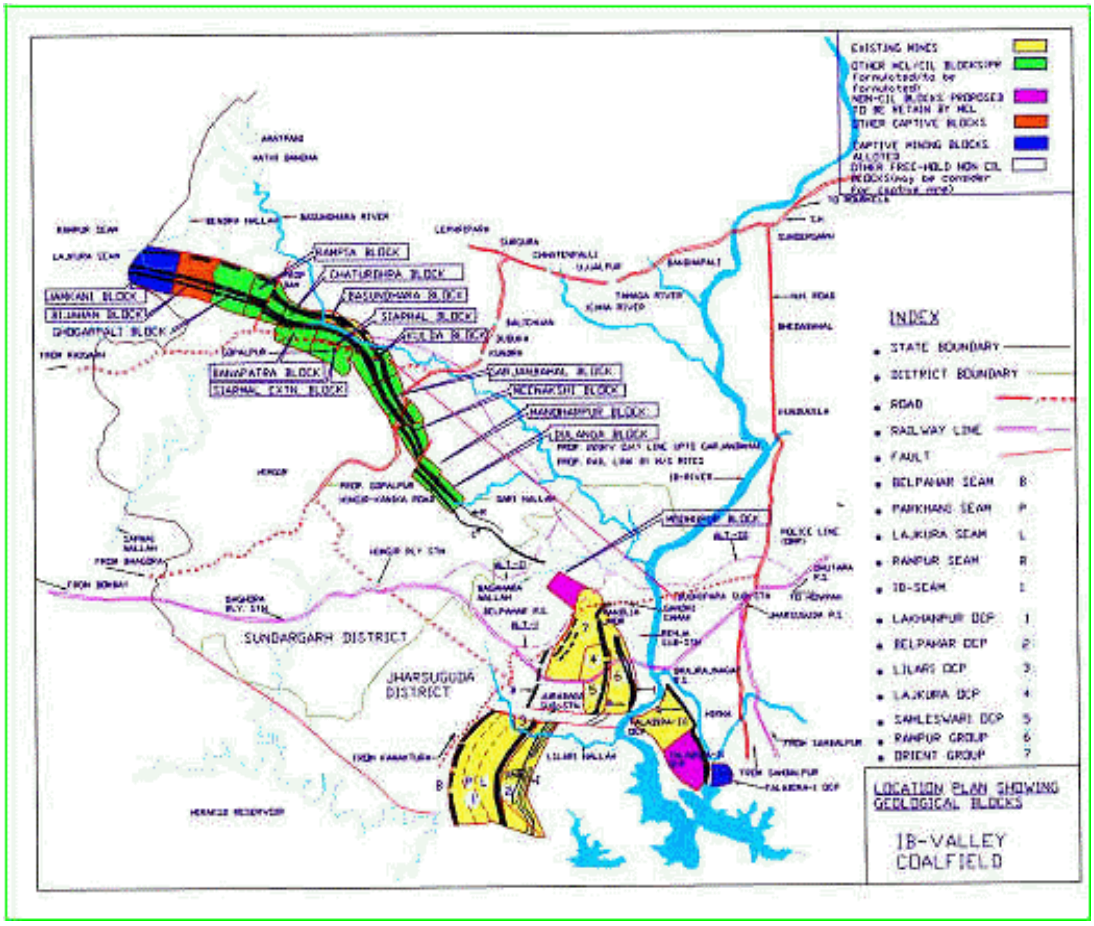
Category	As on 1.04.2010	As on 1.04.2011	As on 1.04.2012	As on 1.04.2013	As on 1.04.2014	As on 1.04.2015
Executive	1262	1526	1643	1851	1873	1884
Supervisors	2513	2696	2977	3042	3140	3260
High Skilled	7987	7500	6892	3275	3222	3225
Semi/Unskilled	7513	7921	8777	12485	12706	12537
Ministerial	1697	1777	1729	1412	1331	1353
Others	06	05	05	00	---	---
Total	20978	21425	22023	22065	22272	22259

Source: http://www.mcl.gov.in/About/emanpower.php

2.13.8. Ib Valley Coalfield

Ib valley coalfield is located at Jharsuguda and Sundargarh districts of Odisha. In 1900 it was discovered by Bengal Nagpur Railway when constructing a bridge through the Ib River. It derived its name from the river Ib, a tributary of Mahanadi River. This coalfield lies between Latitude 21^0 41' and 22^0 06' N and Longitude 83^0 30' and 84^0 08' E, covering an area of 1375 Sq. Km. It has a well-connected road which joins NH-200. In the year of 1909, Himgir-Rampur Colliery was started. Until the nationalization of coal mines in 1973; it was under the jurisdiction of Western Coalfields Limited. In 1986, it came under the supervision of South Eastern Coalfields Limited (SECL) till the formation of MCL.

Map 2.3: Map of Ib Valley Coalfield



Source:http://www.mcl.gov.in/Others/ecoalfields.

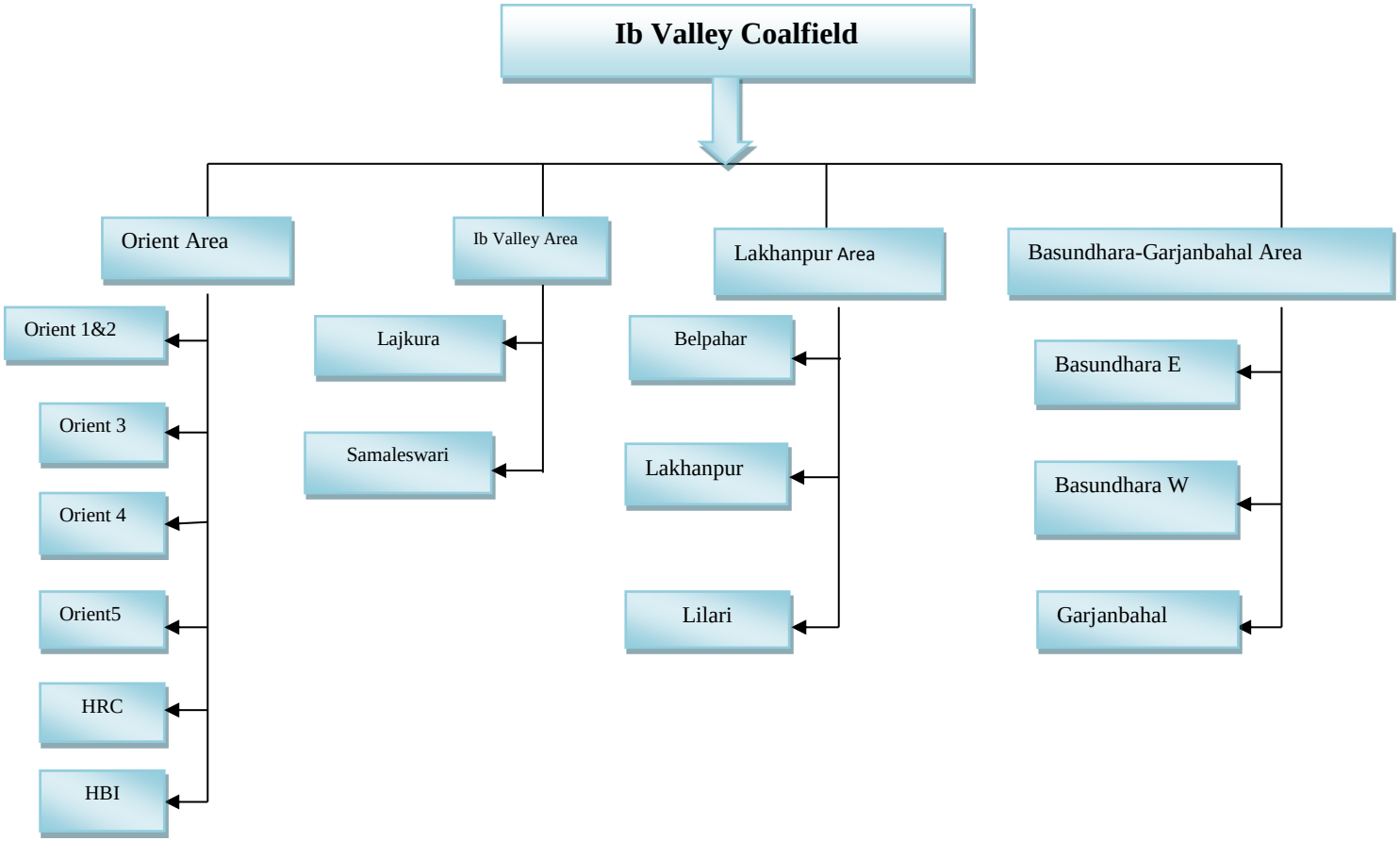
By 1st April 2014, the total coal reserve of Odisha was 75.072 billion tonnes which was about 24.89 percent of the total national coal reserves. Of them Talcher coalfield

continued to be the largest coal producer of MCL by producing 50.174 billion tonnes followed by Ib valley (24.198 billion tonnes) which was the 4th largest coalfields of India. Ib valley is considered as one of the store house of huge thermal grade non-coking coal of Southern and Western India. The quality of coal which IB valley coalfield produces is F, which is favourable for power generation. Owing to this reason the demand of coal from existing and proposed thermal plants are growing day by day.

2.13.9. Operating Areas of Ib Valley Coalfield

It has four operating areas i.e. Lakhanpur Area, IB valley Area, Orient Area and Basundhara-Garjanbahal Area. It comprises of 7 opencast and 5 underground mines. The first three areas are operating with five opencast mines at Jharsuguda district. The Basundhara-Garjanbahal area is having two opencast mines which operate at the Sundargarh district of Odisha.

Figure: 2.4: Operating Areas of Ib Valley Coalfield



The Orient Area is operating with five underground mines i.e. Orient 1 & 2, Orient 3, Orient 4, Orient 5, Himgir-Rampur Colliery (HRC) and Hirakhand Bundia Incline (HBI) underground mines. It was discovered by M/S Brothers Ltd. and has been in operation since 1940. The Basundhara-Garjanbahal Area has three parts i.e. Basundhara East, Basundhara West and Garjanbahal Area. The Basundhara East project was started on 1989 and the rest two mines started afterwards. As on 1st April 2011, the total coal reserve of Basundhara East & Basundhara West was 19.55 million tonnes. The Garjanbahal Area is nearer to the Basundhara area.

The Ib Valley Area is comprises of two opencast mines i.e. Lajkura Opencast project (LOCP) and Samaleswari Opencast project (SOCP). Lajkura Opencast mine is the oldest mine and operating since 1984. Samaleswari Opencast mine was started in 1989 and by 2011-12; it was able to produce 10.9 million tonnes of coal. Lakhanpur area is operating through three opencast mines i.e. Belpahar Opencast Mines (BOCM), Lakhanpur Opencast Project (LKP-OCP) and Lilari Opencast Project (Lilari-OCP). The BOCM was in operation since 1988 followed by LKP-OCP in 1993 and Lilari-OCP in 1984. Lilari-OCP was under IB valley area till 2002 but now it is operating under the control of Lakhanpur Area.

Table No. 2.19: Mining Details of Ib Valley Coalfield

Name of mine	Year of Opening	Nature of Mining	Quality of Coal	Estimated Mine life[1]
Orient 2	1956	Under Ground	D	170
Orient 3	1968	Under Ground	D	69
Orient 4	1977	Under Ground	D	29
HRC	1901	Under Ground	D	58
HBI	1981	Under Ground	D	52
LOCP	1984-85	Open Cast	F/G	30
SOCP	1989	Open Cast	F/G	25
BOCM	1984	Open Cast	F	30
LKP-OCP	1993	Open Cast	F	24
Lilari-OCP	1984	Open Cast	F	25
Basundhara East	1997	Open Cast	E/F	11

Source: MCL Office

[1] Completed mines are now running under the plan of expansion of project.

The above table shows the mining details about IB valley coalfield. Though the Orient 1 mine was started in 1940, it stopped production on 1999. Among the underground mines the production of Orient 3 is highest. Likewise, the production of all the opencast mines except lilari-OCP is increasing over the years. By 2011, among the opencast mines the production of Lakhanpur OCP is highest i.e. 14.01 million tonnes and the production of Lilari-OCP was 0.50 million tonnes which proved a sharp decline than its previous two years. The production of Belpahar OCP was also decreased with compare to its previous year. During 2008-09 and 2009-10, the production of BOCP was 5.0 and 6.54 million tonnes respectively. But a sharp decline was noticed during 2010-11 when the production stopped at the point of 6.0 million tonnes. Whereas the production of other two mines i.e. Lajkura OCP and Samaleswari OCP reported a kind of mixed performance over the years.

As it has been discussed above that five opencast mines i.e. LKP-OCP, Lilari-OCP, BOCM, SOCP and LOCP are in operation at Jharsuguda district. It is enhancing its economy in one hand and decreasing its human and natural capital on the other. As of now Jharsuguda district became an industrial hub for the establishment of several new industries as well as the expansion of old ones.

However, the detailed profile of Coal in India was discussed in the present chapter. But a detailed socio-economic profile of the study area will be discussed in the next chapter.

Chapter-III
Socio-economic Profile of the Study Area

Socio-economic profile is an essential tool to obtain complete social and economic information about any particular community. Further, an analysis of social and economic activity can help to understand the prevailing socio-economic outlines such as demographic details, land holding, household pattern, ethnic composition, language and communication, social organisation, infrastructural details, economic arrangement and political organisation. As it was discussed in the earlier chapters, the present study was undertaken at Ib valley coalfield of Odisha which is a subsidiary of MCL. Then, the endeavour of excavating coal at Ib valley is restricted to two districts of Western Odisha i.e. Jharsuguda and Sundargarh. The present study revolves around the mining affected villages of Jharsuguda district. However, the basic features of sample villages are given in Table No. 3.1.

3.1. Location of the Sample Villages

The present study was undertaken by taking the samples from six mining affected and two control villages. All the mining affected villages are within the vicinity of 3 Km. from the opencast mine sites. On the basis of severity of impact six villages adjacent to three opencast mines i.e. Lakhanpur OCP, Belpahar OCM and Samaleswari OCP were selected. The details of the sample villages are given below.

Table No. 3.1: Distance of Sample Villages from Mining

Sl. No	Name of the Village	Distance from the Mines	Affected By
Mining Affected Villages			
1.	Ubuda	Within 1 Km	Lakhanpur OCM & Belpahar OCP
2.	Darlipali	Within 1 Km	Lakhanpur OCM & Belpahar OCP
3.	Kantatikira	Within 2 Km	Samaleswari OCP
4.	Kudopali	Within 1 Km	Samaleswar OCP
5.	Ainlapali	Within 2 Km	Samaleswari OCP
6.	Khairkuni	Within 3 Km	Lakhanpur OCM
Control Villages			
7.	Talpatia	More than 25 Kms	------
8.	Grindola	More than 20 Kms	------

Source: Fieldwork

From the above table it is pretty clear that all the six mining affected villages are within closure proximity of mines. But the control villages though situated in the same district are more than 20-25 kilometres away from the mining set-up. It is worth to mention here that, control villages are not affected by any kind of industrial intervention and they are still practising their indigenous means of support.

3.2. Basic Infrastructure

Usually the rural villages are self-sufficient to carry out their day-to-day activity. In the present study while the mining affected villages were endowed with rich natural resources, at the same time they were far away from the infrastructural development. With the introduction of mining some infrastructural development took place but at the same time the inhabitants are unable to find their access to common property resources. Mining has ruined this facility. However, the details regarding the basic infrastructure and access to common property resources are given below.

Table No. 3.2: Basic Infrastructure & Access to Common Property Resources

Basic Infrastructure and Access to Common Property Resources	Mining Affected Villages												Control Villages	
	Pre Mining						Post Mining							
	Kudopali	Kantatikira	Ainlapali	Darlipali	Ubuda	Khairkuni	Kudopali	Kantatikira	Ainlapali	Darlipali	Ubuda	Khairkuni	Talpatia	Grindola
Panchayat Office	Y	N	N	N	N	N	Y	N	N	N	N	N	Y	N
Anganwadi Centre	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Primary School	Y	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y
Middle School	Y	N	N	N	Y	Y	Y	N	N	N	Y	Y	Y	Y
High School	Y	N	N	N	N	Y	Y	N	N	N	N	Y	Y	N
College	N	N	N	N	N	N	N	N	N	N	N	N	Y	N
All Weather Road	N	N	N	N	Y	N	Y	Y	Y	N	N	Y	Y	Y
Pond	Y	Y	Y	N	Y	N	Y	Y	N	N	Y	N	Y	Y
River	N	Y	Y	N	N	N	N	Y	Y	N	N	N	Y	N
Nallah	N	N	N	Y	N	Y	N	N	N	Y	N	Y	N	N
Common Well	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	Y	Y
Tube Well	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Bore Well	N	N	N	N	N	Y	Y	Y	Y	N	N	Y	Y	Y
Cremation Ground	N	N	N	N	Y	Y	N	N	N	N	N	N	Y	Y
Play Ground	Y	N	N	N	N	Y	N	N	N	N	N	Y	Y	Y
Grazing Ground	Y	Y	Y	Y	Y	Y	N	Y	Y	N	N	Y	Y	Y
Reserve Forest	Y	Y	Y	Y	Y	Y	N	N	Y	N	N	N	Y	Y
Pasture Land	Y	Y	Y	Y	Y	Y	N	N	Y	N	N	N	Y	Y
Post Office	Y	N	N	N	Y	N	Y	N	N	N	Y	N	N	N

Temple of Village Deity	Y	Y	N	N	Y	Y	Y	Y	N	N	Y	Y	Y	Y
Youth Club	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N	Y	Y
Self-help Group	N	N	N	N	N	N	Y	Y	Y	N	Y	N	Y	Y
Bhagbat Tungi	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	Y	Y
Community Centre	Y	Y	N	Y	Y	Y	Y	Y	N	N	N	N	N	N
Community Health Centre	N	N	N	N	N	N	N	N	N	N	N	N	Y	N
Bus Stop	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y
Daily Market	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Weekly Market	Y	N	N	N	Y	Y	N	N	N	N	Y	N	Y	Y
Police Station	N	N	N	N	N	N	N	N	N	N	N	N	Y	N

Source: Field Study
Note: Y= Yes, N= No

The above Table (No. 3.2) is clearly describing the availability of basic infrastructure and the resident's access to common property resources. It is clearly evident that, in the post mining phase the infrastructural development is quite better in compare to pre mining phase. But the development is not because of MCL, rather the state government is responsible for the implementation of varieties rural development programmes. However, the basic infrastructures such as panchayat office, anganwadi centre, primary school, middle school, high school, college, post office, tube well, bore well, bus stop, community health centre and police station are there because of government initiated rural development programmes. Of them, Kantatikira and Ainlapali villages are coming under Kudopali panchayat. Darlipali is coming under Sarandamal panchayat, Ubuda is coming under Kushuraloi panchayat and Khairkuni is coming under Kudaloi panchayat. While all the mining affected villages have their own aganwadi centres, the villagers of Ainlapali and Kantatikira are coming to nearby Kudopali village to avail middle school and high school. Kantatikira is the only village where not a single school was established. Further, not a single mining affected village is having any college and in order to avail college education the villagers are either going to Belpahar or Brajrajnagar.

All weather roads were a dream for the mining affected villages. But after the initiation of mining industry, the well-connected roads were established. But connecting roads for Ubuda village is not there because the village is going to displace within a year or two. Common wells and tube wells were in existence since pre mining phase. But bore wells came into existence with the govt. initiated rural development programmes. The common property resources (CPRs) such as pond,

river, cremation ground, play-ground, grazing ground, reserve forest and pasture land were present much before the mining era. But these CPRs were destroyed by the expansion of mining wings. All the villages have either own ponds, *nala* or they were dependent on Ib and Bheden River for their daily household activities. Of all the mining affected villages, the residents of Khairkuni and Darlipali were totally dependent on *Lilari Nallah.* Even at present *Lilari Nallah* is the only source of water for Darlipali villagers. Though mining has acquired all kinds of lands, it didn't affect any religious spots. So the temples and other religious sites are still there. Despite of this, the traditional place for chanting *purans* and *bhagawat* is not in practice. Except Kudopali village, not a single village is having it at present.

Community centre has its own importance as people used to unite there to discuss about various social, cultural and environmental matter of their respective villages. But mining has disturbed the unity as well as destroyed the place too. However, under its CSR activity it started taking the initiative to rebuilt community centres in all the mining affected villages. Till yet, only a single community centre was made at Kudopali village and one more was completed by the World Bank Team at Kantatikira village. On the contrary, not a single step was taken to improve the health condition of the non-working communities of MCL. So for the primary health problems the villagers of Kudopali, Kantatikira and Ainlapali are going to Rajpur and Khaliakhan community health centres (CHCs), residents of Darlipali and Khairkuni are approaching the CHC of Belpahar, and the inhabitants of Ubuda are attending the CHC of Odhapara respectively. In order to procure the daily household need the villagers is either going to the daily market of Bandhabahal, Brajrajnagar Township or Kudaloi or they are doing weekly marketing at Gumadera Township or Bundia village. On the other hand, the scenario of control villages is entirely different. Though both the villages are roadside villages, the communication facility is quite good. Even the basic infrastructural facilities and access to CPR are quite good in compare to mining affected villages. Here we can quote that, basic infrastructural development is not taking place at the mining affected villages because the villages are going to displace within some fraction of time.

3.3. Land Acquisition

Access to land plays a significant role in determining the rural society. Basically, the rural inhabitants have closure proximity with the land which also secures their economic and social identity. In one hand it can define the rural wealth and in other hand it can be held responsible for rural poverty too. Therefore, land has a direct impact on the livelihoods of rural poor. But in the present study MCL has acquired majority of land for the purpose of mining and the landless rural people are struggling with this vulnerable state of affairs. The area wise land acquisition can be traced out by analysing the following table.

Table No 3.3: Area wise Land Acquisition, Possession and Balance

(As on 31/03/2014)

Type of Land	Ib Valley	Lakhanpur	Orient	Basundhara	Total
Land Acquisition (in hectare)					
Tenancy	640.875	2200.500	414.870	3235.623	6491.868
Government	125.134	1295.988	309.121	2718.071	4448.314
Forest	348.591	499.150	0.000	2076.359	2924.100
Total	1114.600	3995.638	723.991	8030.053	13864.282
Land in Possession (in hectare)					
Tenancy	621.288	1446.386	414.870	664.977	3147.521
Government	125.134	1295.988	309.121	1021.829	2752.072
Forest	320.412	275.762	0.000	254.268	850.442
Total	1066.834	3018.136	723.991	1941.074	6750.035
Balance (in hectare)					
Tenancy	19.587	754.114	0.000	2570.646	3344.347
Government	0.000	0.000	0.000	1696.242	1696.242
Forest	28.179	223.388	0.000	1822.091	2073.658
Total	47.766	977.502	0.000	6088.979	7114.247

Source: MCL Office

Due to the expansion of mining activities, MCL is continuously acquiring land in different regions of Ib valley coalfield. As on 31st March 2014, MCL has acquired 13,864.282 hectares of land. Of them, 6491.868 hectares are tenancy land, 4448.314 hectares are government land and 2924.1 hectares are forest land. It also possessed 3147.521 hectares of tenancy land, 2752.072 hectares of government land and 850.442 hectares of forest land. Subsequently, the total balance land is 7114.247 hectares. Out of them, 3344.347 hectares are tenancy land, 1696.242 hectares are government land and 2073.658 hectares are forest land.

3.4. Land Holding

Land was regarded as the basic physical asset up till the introduction of mining industry. The rural communities of Ib valley were largely dependent on agro-based livelihoods and for agriculture land was predominantly needed. Prior to mining, the society was agro based and the rural communities were entirely dependent on agricultural production. However, the landless people were in need of the agricultural land of medium and large scale land holders.

Table No 3.4: Magnitude of Land Holders

Category of Proprietors	Mining Affected Villages		Control Villages
	Pre-Mining	Post-Mining	
Landless (0-2.5 acres)	45 (15)	190 (63.3)	6 (6)
Marginal (2.5-5 acres)	48 (16)	45 (15)	8 (8)
Small (5-10 acres)	40 (13.3)	36 (12)	16 (16)
Medium (10-15 acres)	52 (17.3)	24 (8)	31 (31)
Large (> 15 acres)	115 (38.4)	5 (1.7)	39 (39)
Total	300	300	100

Source: Field Study

Note: Figures in the parenthesis are percentage

From the above Table (No. 3.4) it is clearly evident that, during pre-mining phase society was dominated by large scale land holders. But in the post mining phase, majority (63.3 percent) of the households are landless. Then, a minimal difference was observed in case of marginal land holders. As MCL has acquired majority of land for mining activities, very few residents have any control on land. However, in the control villages, majority (39 percent) of the residents are large scale land holders followed by medium (31 percent), small (16 percent), marginal (8 percent) and landless (6 percent) respectively.

3.5. Household Pattern

Housing pattern is an important indicator of economic condition. It was observed that during pre-mining phase majority (43.3 percent) of the residents were staying in the kutcha houses followed by 23.3 percent in huts, 16.7 percent in semi-pucca, 10 percent in pucca and 6.7 percent in temporary houses. The residents who used to live in the kutcha houses were mostly the landless and marginal landholders. While the marginal and medium land holders were living in the pucca and semi-pucca houses, 6.7 percent landless communities were living in the temporary houses. But the scenario is entirely different in the post mining era. Now, majority of the respondents

are having pucca and semi-pucca houses. As the earning is quite good, residents are obvious to build pucca and semi-pucca houses. However, some of the unskilled wage labourers are staying in the kutcha houses and the households who are struggling to get their compensation are staying in the temporary houses, as have already demolished their houses to avail the government decided compensation money.

Table No. 3.5: Household Patterns

House Type	Mining Villages		Control Villages
	Pre-mining	Post-mining	
Kutcha	130 (43.3)	53 (17.7)	52 (52)
Pucca	30 (10)	113 (37.7)	8 (8)
Semi-pucca	50 (16.7)	121 (40.3)	14 (14)
Hut	70 (23.3)	-----	17 (17)
Temporary	20 (6.7)	13 (4.3)	9 (9)
Total	300	300	100

Source: Field Study

Note: Figures in the parenthesis are percentage

But on the other hand, due to low per capita income majority (52 percent) of the respondents are staying in the kutcha houses. While, a small portion (8 percent) of economically well-off people is staying in the pucca houses, second major (17 percent) group of respondents are staying in the huts. Even some of the landless farmers are staying in the temporary houses, as their earning is very less to feed them two times a day.

3.6. Classification of Household

According to the Economic Survey of India (2014-15)if the households or rural area are having the monthly income below 816 rupees then they will be declared as BPL households. However, table no. 3.7 shows that the BPL households were more in number in pre-mining phase. But in post-mining phase the percentage decreased up to 6 percent only. Though mining is providing a permanent and continuous source of income, most of the households are earning more than 816 rupees in a month. Then again, the pre-mining period was mostly agro-based and agriculture was a seasonal activity. That is why most of the households were below the poverty line. In compare to the mining villages, because of the lower per capita income control groups are more in number in the context of BPL list. This can be analysed from the Table No. 3.6.

Table No. 3.6: BPL & APL Households

Type of Households	Mining Affected Villages		Control Villages
	Pre-Mining	Post-Mining	
BPL Households	156 (52)	18 (6)	31 (31)
APL Households	144 (48)	282 (94)	69 (69)
Total	300	300	100

Source: Field Work
Note: Figures in the parenthesis are percentage

3.7. Demographic Profile of the Sample Households

The demographic profile of the sample villages represents the caste wise representation of the sample households of both mining affected and control villages. It also shows the village wise percentage of sample households.

Table No. 3.7: Demographic Details of the Sample Villages

Name of the Villages	General	OBC	Scheduled Caste	Scheduled Tribe	Total
Mining Affected Village					
Kudopali	9 (18)	21 (42)	1 (2)	19 (38)	50 (100)
Kantatikira	0	18 (36)	0	32 (64)	50 (100)
Ainlapali	0	31 (62)	4 (8)	15 (30)	50 (100)
Ubuda	1(2)	21 (42)	2 (4)	26 (52)	50 (100)
Darlipali	0	1 (2)	10 (20)	39 (78)	50 (100)
Khairkuni	5 (10)	19 (38)	5 (10)	21 (42)	50 (100)
Control Village					
Talpatia	1 (2)	29 (58)	6 (12)	14 (28)	50 (100)
Grindola	0	25 (50)	6 (12)	19 (38)	50 (100)
Total	16 (4)	165 (41.25)	34 (8.5)	185 (46.25)	400 (100)

Source: Field Study
Note: Figures in the parenthesis are percentage

From the above Table (No. 3.7) it is evident that the scheduled tribe population is predominant in Kantatikira, Khairkuni, Ubuda and Drlipali villages. In Darlipali village the ST population is 78 percent followed by Kantatikira (64 percent), Ubuda (52 percent) and Khairkuni (42 percent) respectively. But in the control villages i.e. Talpatia and Grindola the representation of ST communities is 28 percent and 38 percent respectively. On the other hand the second largest community of both the mining affected and control villages are OBCs. However, Ainlapali has the highest concentration of OBC communities i.e. 62 percent followed by Kudopali & Ubuda 42 percent, Khairkuni 38 percent, Kantatikira 36 percent and Darlipali 2 percent. In case

of control villages, the concentration of OBC community is 58 percent in Talpatia and 50 percent in Grindola.

The representation of schedule caste is more in Darlipali village i.e. 20 percent followed by Khairkuni 10 percent, Ainlapali 8 percent, Ubuda 4 percent and Kudopali 2 percent. Scheduled caste population was not found among the sample households of Kantatikira village. The representation of General category is almost absent in case of Kantatikira, Ainlapali, darlipali and Grindola villages. Conversely, Kudopali bears the credit of comprising 18 percent General category households, followed by 10 percent in Khairkuni, 2 percent in Ubuda and also 2 percent in Talpatia.

3.8. Age and Gender

Age and gender are two basic criteria which defines position of household head. In the present study, the age distribution of the household head ranges from 25 years to 80 years. In both the mining affected and control villages, the age range is almost same. It can be viewed from the Table No. 3.8.

Table No. 3.8: Age & Gender of the Household Heads

Age of the Household Head	Mining Affected Village				Control Village	
	Pre Mining		Post Mining			
	Male	Female	Male	Female	Male	Female
35-40	----	----	65 (24.07)	4 (13.3)	2 (2.2)	1 (12.5)
40-45	26 (8.9)	----	109 (40.37)	18 (60)	3 (3.2)	2 (25)
45-50	29 (9.9)	3 (33.3)	24 (8.8)	----	7 (7.6)	2 (25)
50-55	37 (12.7)	4 (44.4)	29 (10.7)	4 (13.3)	8 (8.6)	3 (37.5)
55-60	48 (16.4)	2 (22.2)	21 (7.8)	4 (13.3)	9 (9.7)	
60-65	121 (41.5)	----	15 (5.6)	----	12 (13.04)	
65-70	11 (3.7)	----	7 (2.6)	----	26 (28.2)	
70-75	9 (3.09)	----	----	----	11 (11.9)	
75-80	6 (2.06)	----	----	----	8 (8.6)	
80 & Above	4 (1.4)	----	----	----	6 (6.5)	
Total	291	9	270	30	92	8

Source: Field Study
Note: Figures in the parenthesis are percentage

The Table drawn above (No. 3.8) shows that, during the pre-mining period majority (97 percent) of the households were patriarchal and only 3 percent households were female headed. It was also informed that, majority (41.5 percent) of the household heads belong to the age group of 60-65 years. But in the post mining era, the residents

are staying in the nuclear families. Because of this reason majority (109 percent) of the respondents belong to the age group of 40-45 years. Even a remarkable shift was marked in the context of women headed households. While in the pre mining stage it was only 3 percent, in the post mining phase it increased up to 10 percent. On the contrary, in the control villages majority (92 percent) of the households are practising patriarchal family system and majority (28.2 percent) of the household heads belong to the age group of 65-70 years. At the same time, in the control villages, 8 percent female headed households were also observed.

3.9. Occupation

Usually the term 'occupation' denotes a definite means of earning to sustain a livelihood. However, the major sources of occupation for rural communities are agriculture, wage labourer, dairy and other allied services etc. But the intervention of mining has changed the scenario of Ib valley. At present residents of Ib valley are either have permanent employment in the mines or they are working as wage labourers in the nearby mines. Agriculture as a source of occupation has lost its significance because of land acquisition and pollution. This can be analysed from the Table No. 3.9.

Table No. 3.9: Occupation of the Sample Households[2]

Occupation	Mining Affected Villages		Control Villages
	Pre Mining	Post Mining	
Agriculture	196 (65.3)	32 (10.7)	38 (38)
Wage Labourer	59 (19.6)	83 (27.7)	22 (22)
Dairy & Allied	20 (6.7)	----	17 (17)
Mining	----	153 (51)	----
Others	25 (8.4)	32 (10.6)	23 (23)
Total	300	300	100

Source: Field Study

Note: Figures in the parenthesis are percentage

[2] Detailed Occupational scenario was given in Table No. 5.1, Chapter-5.

Table No. 3.10: Caste Wise Educational Qualification

Educational Qualification	Mining Affected Villages								Control Villages			
	Pre-mining				Post-mining							
	SC	ST	OBC	GC	SC	ST	OBC	GC	SC	ST	OBC	GC
Illiterate	9 (40.9)	91 (59.8)	36 (32.4)	----	4 (18.2)	51 (33.6)	28 (25.2)	----	4 (33.3)	8 (24.2)	30 (55.6)	----
Literate (No formal education)	7 (31.8)	8 (5.3)	12 (10.8)	----	1 (4.5)	12 (7.8)	7 (6.3)	----	----	5 (15.2)	6 (11.1)	----
Primary	3 (13.7)	28 (18.4)	30 (27)	5 (33.4)	7 (31.8)	28 (18.5)	32 (28.8)	----	5 (41.6)	9 (27.3)	14 (25.9)	----
Middle	2 (9)	23 (15.2)	13 (11.7)	2 (13.3)	8 (36.3)	25 (16.4)	16 (14.4)	3 (20)	2 (16.7)	11 (33.3)	1 (1.8)	----
Matriculate	1 (4.6)	2 (1.3)	20 (18)	2 (13.3)	2 (9)	21 (13.8)	25 (22.5)	6 (40)	1 (8.3)	----	2 (3.7)	1 (100)
Intermediate	----	----	----	2 (13.3)	----	7 (4.6)	2 (1.8)	----	----	----	1 (1.8)	----
Graduate & Above	----	----	1 (0.9)	3 (20)	----	3 (1.9)	1 (0.9)	4 (26.7)	----	----	----	----
Professional Qualification	----	----	----	1 (6.7)	----	5 (3.3)	----	2 (13.3)	----	----	----	----
Others	----	----	----	----	----	----	----	----	----	----	----	----
TOTAL	**22 (100)**	**152 (100)**	**111 (100)**	**15 (100)**	**22 (100)**	**152 (100)**	**111 (100)**	**15 (100)**	**12 (100)**	**33 (100)**	**54 (100)**	**1 (100)**

Source: Field Study

Note: Figures in the parenthesis are percentage

3.10. Education

Education plays an important role for the social well-being of a society. After food, clothing and shelter, it is a basic necessity for the up-liftment of human values. But in the present study, this facet is immeasurably neglected. As it was given in the Table No. 3.10, during the pre-mining phase illiteracy was high among the Scheduled Tribe (ST) populations. In the post-mining phase, though the percentage of illiteracy has come down but now also the illiteracy rate is more among the STs. But remarkable difference was found in the category of professional qualification and graduation. In the pre-mining phase, not a single household from SC and ST was attained intermediate and graduate education. Even only the general category households were possessed professional qualification. But this scenario is entirely different in the post mining era. Devoid of any caste, the economically well-off people are attending the educational institutions. On the other hand, the control village scenario is somewhat similar with the pre-mining phase. Here, majority of the respondents are illiterates and not a single household is reportedly attended any college or professional education.

3.11. Particulars and Distance

The mining affected villages are far away from the township area of Jharsuguda district. So the villagers are going far away to avail the transportation facility. This can be analysed from the Table No. 3.11.

Table No. 3.11: Particulars and Distance

Name of the Villages	Mining Affected Villages					
	Place/ Distance					
	Bus Stop	Railway Station	District HQ	Block HQ	Health Centre	Police Station
Ainlapali	Brajrajnagar (10 KM)	Brajrajnagar (10 KM)	Jharsuguda (33 KM)	Jharsuguda (33 KM)	Khaliakhani (17 KM)	Brajrajnagar (10 KM)
Kantatikira	Brajrajnagar (8 KM)	Brajrajnagar (8 KM)	Jharsuguda (31 KM)	Jharsuguda (31 KM)	Khaliakhani (16 KM)	Brajrajnagar (8 KM)
Kudopali	Brajrajnagar (10 KM)	Brajrajnagar (10 KM)	Jharsuguda (32 KM)	Jharsuguda (32 KM)	Khaliakhani (15 KM)	Brajrajnagar (10 KM)
Darlipali	Bandhabahal (4 KM)	Belpahar (12 KM)	Jharsuguda (30 KM)	Lakhanpur (12 KM)	Belpahar (12 KM)	Lakhanpur (12 KM)
Ubuda	Bandhabahal (6 KM)	Belpahar (8 KM)	Jharsuguda (35 KM)	Lakhanpur (11 KM)	Odhapara (3 KM)	IB Thermal (10 KM)
Khairkuni	Kudaloi (1 KM)	Belpahar (11 KM)	Jharsuguda (25 KM)	Lakhanpur (6 KM)	Lakhanpur (7 KM)	Lakhanpur (7 KM)
Control Villages						
Talpatia	Talpatia	Jharsuguda	Jharsuguda	Jharsuguda	Talpatia	Talpatia

	(Within village)	(10 KM)	(10 KM)	(10 KM)	(Within village)	(Within village)
Grindola	Grindola (Within village)	Belpahar (12 KM)	Jharsuguda (30 KM)	Lakhanpur (22 KM)	Belpahar (12 KM)	Lakhanpur (22 KM)

Source: Field Study

The Table drawn above describes the important places and their distance from the respective villages. It is clearly evident that, all the mining affected villages are far away from the district headquarter. Even Grindola village is 30 kilometres away from the district headquarter. But Talpaia is only 10 kms away from the district headquarter. Both the control villages are having their own bus stop. But the mining affected villages are going to distance places to get the bus facility. All the mining affected and control villages have one thing in common, as they all are going either Brajrajnagar or Belpahar railway station to catch a train. Further, the mining affected residents are travelling more distances to avail the primary medical treatment. In contrast to this, Talpatia has its own CHC but the villagers of Grindola are going to Belpahar to avail the primary medical treatment.

3.12. Ethnic Composition

The study area has 19 caste groups and 10 tribal groups. Among the caste groups the predominant castes are *Kulta, Goud, Chamar, Teli* and *Brahmin*. The *Brahmins* are the dominant caste among the general category section. The *Kulta, Kamar, Teli, Goud, Bhandari, Kumbhar* etc. are amongst the OBCs. The *Chamar, Paap, Ghasi, Mali* etc. are coming under the section of Scheduled Caste communities. Among the tribal groups the sub tribal sections are *Bhuiyan, Gond, Munda, Oram, Harijan, Kisan, Saura, Majhi, Paap* and *Kondhs.* Of them, the *Gond, Bhuiyan, Oram, Munda* and *Saura* are the dominant tribal groups of the study area.

3.13. Social Organisation[3]

The social organisation of the villages lies on the different structural systems like caste, clan, communal tie-up, kinship relation, family structure and marriage functions, Jajmani system, power structure, fairs and festivals etc. In the study area the amalgamation of different castes and sub-castes are there. The traditional caste and the feeling of untouchability is still persists among the villagers. Though not

[3] Detailed analysis on social organization was given in Chapter No. IV.

much strong, still the Jajamni system is still persist among the villagers especially among the control villagers.

3.13.1. Marriage

Marriage is one of the indispensable parts of the villagers. Both the traditional and modern form of marriage is popular among them. The villagers are in favour of monogamy and practising clan exogamy mostly. The dowry system is more prevalent among the mining affected villagers. The marital status of the villagers is given below.

Table No. 3.11: Marital Status of the Household Head

Name of the Village	Married	Un-married	Widow/ Widower	Divorcee	Total
Mining Affected Villages					
Ainlapali	43 (86)	-----	7 (14)	-----	50 (100)
Darlipali	37 (74)	-----	13 (26)	-----	50 (100)
Kantatikira	47 (94)	-----	3 (6)	-----	50 (100)
Kudopali	49 (98)	-----	1 (2)	-----	50 (100)
Khairkuni	44 (88)	-----	6 (12)	-----	50 (100)
Ubuda	41 (82)	-----	7 (14)	2 (4)	50 (100)
Control Villages					
Talpatia	46 (92)	-----	4 (8)	-----	50 (100)
Grindola	41 (82)	-----	9 (18)	-----	50 (100)

Note: Figures in the parenthesis are percentage
Source: Fieldwork

The Table (No. 3.11) drawn above is describing the marital status of the household heads. Among the mining affected villages, majority (98 percent) of the residents of Kudopali village are married. Not a single case of unmarried resident was found. At the same time, highest percent (26 percent) of widow/widower was found in Darlipali village. As the cases of divorce are not very popular in the mining affected villages, still 4 percent divorcees were found. Conversely, majority of the respondents of control villages are married and only 26 percent residents are reportedly widow/widower.

3.13.2. Family

'A family is a fundamental social group in society typically consisting of one or two parents and their children.' It has several connotations. The family system in the mining affected villages is mainly nuclear family. Though nuclear families are also found in the control villages but the proportion is very stumpy. All most all the households of the study area are of patriarchal types. However, with the changing scenario the decision making process is somewhat changing. Now the collective and communal decision making process is coming across in place of individual decision making.

3.14. Language & Communication

In the study area irrespective of their caste and community all the local people are communicating with each other in *sambalpuri* language. Up to some extent they are also able to speak in Odia language. However, they used to write in Odia script. As the economically well-off residents have enrolled their offspring's in the schools such as *Saraswati Sishu Mandir* and DAV Public School, they are able read, write and speak in English and Hindi languages too.

3.15. Political Organization

With the amendment of 73rd Amendment Act the three tier political system is in execution since 1992. In the grass root level the head of a panchayat is called as sarpanch followed by a group of other members called as ward members. And it is the responsibility of the panchayat members to choose naib sarpanch among them. All the villages of the study area are under the jurisdiction of Lakhanpur and Jharsuguda tahsils. Every sample village has their own sarpanch, ward member and naib sarpanchs.

3.16. Economic Organisation

The economy of the mining affected villages is mainly mine-based. Those who lose their land of any kind in the mines became the beneficiaries to avail the job at mines according to their qualification. According to the rule of MCL, those who are 10th pass got job in the opencast mines and those who are under metric are working in the underground mines. But in the control villages the primary source of livelihood is

agriculture. They have no other interventions and they are practising their indigenous livelihood till yet.

3.17. Culture & Religion

Because of the intervention of mining activities the culture of the mining affected villages are deteriorating. They are becoming more profit making engines. But the control villagers are able to preserve their culture in such a way it cannot be affected by any force. Out of 400 hundred household only one household was reported as muslim household. 399 households were hindu households. The residents of Ib valley are practising many agro-based festivals such as *Nua Khai, Lakhmi Puja, Pausha Purnima, Rasa Purnima* etc. Except these they used to celebrate some other non-agro-based festivities such as *Gokulastami Jatra, Naam Yangya, Ranjta Festival, Savitri Brata, Bhai Jiuntia* etc.

Chapter-IV
Impact of Mining on Rural Social Structure

4.1. Introduction

Society is a wide-ranging and multifaceted social union which has survived ever since the initiation of human civilization. It is one of the most complicated social organisations where all the features of human social life are revolving around. Subsequently, it is reconsidered as an approach, in which function in one part influences all the outlines of social gathering. Moreover, it is an object on which no one has any control; still it controls everyone's subsistence. Therefore, the function of this well-designed independent body is manifold. At first, all the social interactions and inter-relationships transpire within the array of society. In the second phase, it endeavours to become a self-reliant body to supply all the necessary goods and services to its adherents. In the third phase, a society bears the weightage of an eventual managerial entity of its adherents as well as it works out authoritative inclination on all judgements regarding them.

Human life and society are dependent upon each other and the existence of man is honestly impossible without society. It is often regarded as a complex social system, which is designed by the interface of communication and reciprocated habit of individuals. In a society every actor has a predefined social role which can be discussed by taking the example of a production team, where people used to amalgamate together owing to the interest of production as well as for some welfare measures. During the process they interchange some political, moral, aesthetic, scientific and other values. Then the group delivers civic views, improves the mind-set and figure outs the character. In this way the group helps a person to develop the level of personality and project itself as a self-identified entity. So the group helps a person to develop its own personality and at the same time group refines its outline by the society (Spirkin, 1983).

It is pretty clear from the above discussions that, society plays the role of a guardian which guides every part of social relation. Though, it has its base from interaction and reciprocal reliance of individuals, it deals with the multiple dimensions of human

nature which itself is complex in nature. In its credit, society carries social relations from the horizons of timeworn past. Social relations are present in the society in the complex whole of social systems in a structural mode and in a coherent manner. Since complexity is an extensive occurrence, the need of social structure is necessary to understand the complex nature of social systems.

The Latin word 'structure' has derived from *struere*, which means 'to build'. In the Latin sense the *ure* denotes the outcome of a process. So the term structure in general, refers the outline of essential ingredients which constitute of building something (Lopez & Scott, 2001). In its broad-spectrum "structure" refers to the conventional associations among the components which have some degree of implication with rationality and constancy. It also, can be, perceived as an observation of a set of ideas, which can be put on any section of realism if at all we identify a definite obligation. In social sciences the term structure denotes the persistent features of social reality, its foundation and its fundamental arrangement. In this way it also helps to differentiate the primary features of society from the secondary ones, the vital traits from the surplus ones and the constant ones from the conditional ones (Boudon, 1968). Thus the concept of social structure denotes, in a common way, a systematic and planned process of fundamental features.

Structure deals with the systematic investigation of a defined entity. For example, there are different branches of science, and each of them invariably deals with definite aspects of some defined structures, e.g., atomic physics concords with the structure of atoms, chemistry deals with the structure of molecules, anatomy deals with the structures of organisms etc. But in social science, the term social structure was adopted by social scientists to address different macro and micro level interpretations. The famous anthropologists Evans-Pritchard conceived the term 'social structure' to define social groups i.e. nations, tribes, clans, that can preserve their permanency as individual groups despite the variations in their memberships. The sociologists perceive social structure as an exact social relation between two persons which happen to be a part of wide network of social relations, and which implicates many other persons. Radcliffe Brown defined social structure in two phases. In the first phase he kept all social relations of person to person. To define this, he took the example of an Australian tribe, the social structure of which is established through

genealogical connections. In the second phase he defined social structure as the differentiation of individuals and their social role. For him the distinct social positions of men and women, chiefs and commoners, employers and employees are the basics of social relations which have its dwelling in diverse fraternities (Radcliffe-Brown, 1940).

Bernardi, Gonzalez and Requena developed two different approaches i.e. the institutional vision and the rational vision, to define the term social structure. In the institutional or cultural vision they defined some basic elements of social structure i.e. norms, beliefs and values which control social action. For them the sociological tradition comprehends social structure as an institutional structure which has a strong determination in the streams of thought and which preserves the cultural determinism of human behaviour. The cultural model to define fundamental structure of social relations was aptly reflected by the contributions of Talcott Parsons. Secondly, under the rational vision, they identified some basic elements which are responsible for the institution of social structure. They are ultimately social relations, which unites individuals, groups, organizations, communities and societies. This vision has a clear indication of Marxian work which indicates social structure as a co-ordination of dealings between dominated and dominant classes, and which has its origin in the modes of production of a particular society (Bernardi, González & Requena, 2007).

From the above discussion it is clear that the perception of social structure is relatively stable and gives emphasis on the fact that society is clustered with a given set of roles, which has diverse functions, implications, significances and also has dissimilar resolutions. It has a stratified nature and stringent function in its segment. Social structure in one hand influences the economic system, legal system, political system, cultural system and many more. In India social structure encompasses the family structure and function, marriage pattern, kinship relation, *jajmani* system, observation of fairs and festivals, caste and clan, work and labour, social relation and community participation etc.

India is a country with rich natural heritage. It bears the weightage of naturally well-designed hub that preserves its natural environment in such a way that it has the ability to invite the commercial activities to exploit the same. In the era of globalization, in order to uphold the country in the wave of development, varieties of

commercial activities including mining has emerged. Though the impact of mining is large-scale, still we cannot overlook the loss in the sphere of social structure as it also bears the changes in large scale. We cannot ignore the fact that change in one aspect provokes the change on other aspects too. When mining is taking place in large scale it not only shades impact on environment, livelihood or health, but also the structural aspects are implementing insignificant changes.

4.2. Mining & Social Aspects: An Overview

Mining disturbs strong cultural ties of the indigenous communities and also disintegrates their culture and identity (Baguilat, 2011). Ever since the intrusion of mining industries, the coal belt of upper Assam has countersigned some socio-cultural alterations. The rural society of this belt is becoming urban and the process of migration is giving birth to a new class of people who are engaged in making contracts with the coal company for the export of coal. On the other hand the company is hiring Bengali employees to work in the mines and owing to this reason; the Bengali culture is acquiring a dominant place in the region (Sen, 2013). With the development of coal mining, the socio-cultural adjustment in the mining belt is becoming worse and the issues like crime, divorce, consumption of alcohol and high incidence of variety of diseases are increasing in the mining belt of San Juan country and the village of Cuba (Supalla & Gray, 1977). Not only the socio-cultural setup has been disturbed, it has also messed up the traditional socio-political systems which leads to the disorganisation of the community and their sense of unity (Wetzlmaier, 2012). Even some of the neighbouring communities were identified with considerably stronger socio-cultural parameters than the economic ones. According to them they are tackling both positive and negative socio-cultural factors. In one way due to mining they are departing from their agricultural land while on the other side their infrastructural development such as better housing and education facility, adequate health care facility, well-connected roads etc. is getting positively influenced. With loss of agricultural is land they are deviating from their traditional pattern of livelihood (Garvin, McGee, Smoyer-Tomic, & Aubynn, 2009).

The permanency of cultural inheritance is very difficult to maintain as it is undergoing the phase of transformation. However, the vulnerable communities find it difficult to maintain cultural continuity as the mining activities are separating them from their

traditional homestead and agricultural lands. So the displaced communities are not sufficiently expert to maintain a connection between the ancestors and future generations. The loss of spiritual connection with the land is diminishing their knowledge on traditional skills which they established over generations. Even the destruction of magnificent landscapes is reducing the enthusiasm towards art, music, prose and poetry. With the loss of peace of mind and worry for sustaining a usual pattern of existence there is growing infidelity towards the prevailing democratic system (Stockman, 2004).

Mining bears a substantial character in determining the human development seen from the perception of technological advancement, and at the same time poses an obstruction to the adjoining communities. Though there are several impacts of mining and lot of measures are taken to tackle the issue, still some methods should be employed while discussing about its social dimensions. As the mining boom endangers the social gravity and enormity, dealings and interfaces, communication and participation etc., the hosting communities faced frequent challenges to adapt to the alterations occurred. Sometimes the community members react towards the process of social change and even put efforts in sustaining the prevailing quality of communal cohesiveness. Even they are used to develop certain creativities to acclimatize with the new environment (Marinova & Petrova, 2012).

Usually mining upholds outsized regions for its business, and in turn, engenders social conflict. Though it is true that social conditions decide the complete execution of a mining project, still the focus of achieving profits is higher than the negative consequences. Sometimes the local inhabitants were so much influenced by the positive aspects of having economic gain that they used to underrate the negative side of this endeavour. Most of the time the prime occupants did not speculate any concern towards the legal regulation of public participation in the decision making process (Badera & Kocon, 2014b). The benefit bearing communities are arguing in favour of mining industry but the groups who are unfortunate to avail only the negative impacts of mining do not have a voice to rise against the injustice (Petkova et al., 2009).

Many a time an unusual hassle occurs when a large amount of workers from the neighbouring habitats are paid employment in the adjacent mining operations, which

upshots insignificant demographic changes (Hilson, 2002). This in turn leads to the foundation of some undesirable interruptions such as distraction from communal equilibrium, change in the way of life, disintegration of shared beliefs, customs, political systems, values and language, local culture, disruption towards archaic mode of hunting and fishing, change in family structure, growing demand for property and native capitals, constant worry for water supply and local sewage system, introduction of amplified cost of living, and proliferation of some socially avoidable accomplishments such as prostitution (Vanclay, 2002).

However, the study of social structure differs from region to region. The cultural practice and ethnic identity presents a uniqueness to capture the various aspects of social structure. In India, social structure is the amalgamation of some social institutions and organisations such as family structure, marriage pattern, kinship relation, caste system, *Jajmani* system, power structure etc. A detailed study on the changes of these spheres of social structure will be given below.

4.3. Impact of Mining on Family Structure

Rich cultural heritage and profound tradition epitomizes the actual image of Indian society. With the apex of diversified customs and the emblem of ironic civilization, the Indian society reflects the exact shadow of India despite the widespread customs, traditions, rituals and fiestas. Indian society was exemplified again and again for its abundant social values and glorious social institutions. In the midst of time, Indian society is undergoing a number of alterations in every stratum of its culture and tradition. Though the culture and tradition are going through the phase of significant modifications, the transformation in the structure of social institutions is an obvious concept now. 'The family' which is considered as a universal social institution has been going through a process of rapid change in recent years. The traditional practise of the family in India is generally entitled as joint family (Mandelbaum, David, 1948). It represents a value loaded feature of the Indian social life. In a joint family, a number of people from several generations live together under a common roof and shares a common hearth. But the more suitable definition given by Smt. Iravati Karve, describes the joint family as "a group of people who generally live under one roof, who eat food cooked at one hearth, who hold property in common, and who

participate in common family worship and are related to each other as some particular type of kindred".

This family system in India is going through a process of change as it is experiencing domestic violence, divorce and separation, family disorganisation, drug abuse, juvenile delinquency etc. (Sonawat, 2001) which in turn has introduced nuclear family system. The change in family structure is not at all obvious; rather it occurs as a result of inability to cope with the race of new economic development. When source of livelihood was not so diversified and society was mostly an agro-based, human mobility was limited. The joint family system which was based on the principle of joint ness best suited to an agrarian society where mobility was limited; specialization was simple and custom was indisputable. But following a process of change due to industrialization in the form of mining the traditional joint family in India has also shown a remarkable change in its structure and function. Mining which enters as an externality came with industrialization, modernization and urbanization. It opened up and widened the scope of sources of livelihoods.

In the present study the respondents of mining affected villages were found to practise joint family system before the introduction of mining activity. They used to carry out social cohesiveness till the loss of their agricultural and homestead land. In rural India, land is considered as a prime source of sustenance which connects the family members beneath one roof. When land is acquired for mining, the adjoining communities become jobless. And this in turn results in inequality, discrepancy, disagreements and sometimes even intra-personal conflicts among the family members.

In the mining-affected villages the presence of joint family system is very less than the control villages. According to the Resettlement and Rehabilitation Policy of MCL, it arranges the provision of job for the eldest son of each entitled family while leaving the others with no assurance of any means of livelihood. When a person becomes a job holder, immediately he starts living separately. So the other family members either migrate to the nearby regions or continue living in the same village by holding their separate household. In some cases though they are living under one roof, they maintain a formal relation with each other.

The practise of joint and extended family was higher during the pre-mining period (Table No. 4.1). But it has undergone a sheer decrease all through the excavation of mining projects. In this regard, when the household members were questioned regarding the prevalence of family structure, all the respondents of both mining affected and control villages responded categorically. So the valid percent of all the categories are equal to the percentage. Here it is worth to mention that, valid percentage is the percent of respondents who replied.

It was reported that in the mining affected villages around 20 percent households were practising joint family system followed by 1.7 percent extended family system. But the scenario was quite different much before the mining activity (Table No. 4.1). Prior to mining the respondents of mining affected villages were in favour of joint and extended family rather than nuclear family. About 74 percent households were in practise of joint family system and 24.7 percent households were regarded as the members of extended family. However, it was discussed earlier that land bears the central characteristic of ruralites and prior to mining agriculture was the major source of livelihood for them. They maintained equilibrium by displaying their enthusiasm towards a joint living. However, it is the land that has borne weight of an arbitrator to retain symmetry between the family members. As the source of livelihood was mostly confined to the land and forest, which needs a collective effort to cultivate and gather, villagers were staying together in a joint family. But this harmony was shifted towards individualistic attitude when MCL started acquiring land and provided compensation in terms of job in the mines to a single member of each project-affected family. This in turn, is responsible for jealousy, hatredness, competition, and many a time for involuntary servitudes.

Table No. 4.1: Type of Family Structure

Mining Affected Village (Pre-Mining)		
Type of Family	Frequency	Percent
Joint Family	222	74.0
Nuclear Family	4	1.3
Extended Family	74	24.7
Total	300	100.0
Mining Affected Village (Post-Mining)		
Joint Family	60	20.0
Nuclear Family	235	78.3
Extended Family	5	1.7
Total	300	100.0
Control Village		
Joint Family	56	56.0
Nuclear Family	32	32.0
Extended Family	12	12.0
Total	100	100.0

Source: Field Study

To fulfil their economic greediness sometimes the villagers preferred to establish their separate nuclear household. Nuclear families have become popular in the mining affected villages as 78.3 percent households were found to be more agreeable by practising it. The nuclear family members project their approach as concrete by explaining that, the nuclear families are ideal types as it gives rise to less quarrels among the family members, assures individual freedom and individual identity, diminishes financial burden, reduces supremacy by other elders in the family and guarantees individual choices. Moreover, it is perhaps the establishment of mining industry which embrace the cloud of transformation, and possibly it is supplemented more fuel towards the introduction of modernised institutions such as nuclear family.

In contrary to the mining affected villages, the control villages are in no way affected by the mining activity. As a result, it is noticeably evident that the residues of control villages are more in favour of joint and extended family system rather than nuclear family system. The above table clarifies that around 56 percent of households are staying in the joint families where as 12 percent families managed to preserve their extended family system (Table No. 4.1). The control villages of the study are located in close proximity to nature and the primary source of their income is agriculture. The family members are put into practise agriculture collectively and it produces a clear

picture of unity, equilibrium and social cohesion. The present situation does not depict the image of any social trauma within the clans. As a result all the kin members take active involvement in all the family events which conserve the family structure.

4.4. Impact of Mining on the Functions of Family

Functionalists and structural functionalists who believe on organic analogy see society as being similar to a biological organism for example the human being. Human body is made up of different parts which work together for the smooth functioning of human health. Just like human body, functionalists claim that society which is made up of various institutions function well as long as various institutions work together. If any institution quickly modified or failed to work with other institutions, society will be dysfunctional or will react in a different way. Change in one aspect brings about change in other aspects too. So a kind of direct influence was observed in the functional dimensions of family as an outcome of structural changes in the perspective of family. Functionalists like Parsons and Dennis, debate that in current society, family has lost many of its functions that were once performed in pre-industrial society. In the words of M. Francis Abraham, family exhibits six major functional features such as procreation, sexual regulation, economic support, social placement, socialization and emotional security[4].

Procreation: Every single society necessitates of framing an absolute substitute to its members. Through marriage, family controls and institutionalises the procreation activities of human being. By fulfilling its reproductive function, family contributes in the propagation of species and hence in the perpetuation of the human race. In the present study with the proliferation of mining industry family members migrate to other places in search of economic security separating themselves from other members of their family. As the introduction of mining has brought certain change in the structure of family, few members are left at home to take care of children. With mining, there entered some external factors such as urbanization, loss of traditional sources of livelihood, immigration etc. which increased the cost of living in the mining affected regions. Due to all these reasons parents are no longer interested in having more number of children. Previously, senior members used to decide about the

[4] Abraham, M.F. 2014, *Contemporary Sociology: An Introduction to Concepts and Theories*, Oxford University Press, New Delhi.

family size. At present most of them are staying in nuclear families and it is the individual parents deciding their family size. However, the basic thrusts of these functions are still intact. The very survival of the human race is based on reproduction.

Sexual Regulation: Family regulates the biological necessity of society. In no way it sanctions any susceptible action. It consists of predefined status and roles which regulates the individuals to act accordingly in given social positions. Satisfaction of sex needs is one of the prominent functions of family. Though we do not find much change with regard to important function still there are few changes that have been remarkable. Modern family has failed to some extent to exercising its traditional control in regulating sexual behaviour of its members. With the rise of mining, most of the family structures have reformulated from being collectively enlarged family to nuclear family. The absence of other kins like grandparents in nuclear families and the busy schedule of parents makes it difficult for their children to develop family values, morals etc. In addition to this the growing children are engaging themselves in various socially restricted promiscuities. In the current study almost all women population of scheduled caste and scheduled tribe groups are working in nearby mines under the supervision of contractors. And many a time they are sexually exploited by the contractors only to maintain a regularity of their work. Sometimes in order to maintain an economic balance in their family expenditure and to cope with the rapidly increasing market price, a cluster of women take to prostitution.

Economic Support: In pre-mining society, family was the hub of production as well as consumption. During that period, agriculture was the prime source of livelihood and all the family members were into this profession to came across financial prerequisites of their family. In the contemporary era, mining has grabbed almost all the agricultural and forest lands. While there is no land left for agriculture and other allied activities, family as a unit of economic support breaks down. The family is no longer united by shared work; rather its members prefer to work separately. Henceforth, it becomes a consuming unit rather than a production centre. Most of its economic functions are achieved by the industrial units. In other words, industry fulfils the needs of family. As a result, family members mostly desire to work in industries and other allied activities rather than to work in agricultural fields. Consequently, economic importance of family declined manifold.

Social Placement: Every individual is familiar with the shared attributes of a family. From birth human young adores certain inherited status of being a member of a definite caste, class, religion, language etc. With the arrival of mining the restructure of modern nuclear family is getting popularised, and the importance of caste, class, religion etc. turned out to be mere concepts of an age-old society. Devoid of any caste, class or religion, the mining affected people are in a race to increase their economic standard rather than social characteristics.

Socialization: Socialisation is a practice of introducing an individual into the social world[5]. The family is usually considered as the most important agent of socialization. From birth human infants are completely dependent on their parents and other family members for their sustenance. From the beginning, family members inculcate the importance of family values, morals, responsibility sharing, importance of social norms, ethics etc. within a child. Hence throughout his life the child attempts to uphold those familial and social values taught to him. But the speedy disorganisation of traditional family system leads an absence of socialization in the mining affected villages. The children therefore growing in the nuclear families have no other family members to take proper care of them. Moreover, their workaholic parents find it difficult to spare time to develop traits of socialization within their children. So the socialization process remain as a matter of past for the mining affected communities.

Emotional Security: Emotional security has a significant importance in an individual's life. Although child bearing and rearing can take place outside the family, still the amount of security a child receives in a family is a matter of significance. The residents of mining-affected villages revealed that prior to mining they enjoyed equilibrium and solidarity and were in a position to face any kind of unpleasant situations unitedly. But now there is a complete change as inhabitants are developing individualistic attitudes within themselves. And as most of the respondents are living in a nuclear family it is difficult to share their emotions.

Except these six functions, mining brought remarkable alterations in the role of old age population and women. Previously, old parents were regarded as the head of the household and the decision made by them were considered as final. On the contrary,

[5]Rao, C.N.S. (2001). *Primary Principles of Sociology with an Introduction to Social Thought* (Third). New Delhi: S. Chand & Company.

women folks were regarded as the home makers and their duty was only restricted to household chores including child bearing and rearing. But with the prolonged expansion of mining activities, there has been a significant shift in the duties of family members. This can be analysed from the following assertions.

4.4.1. Impact of Mining on Old Age Population

The shift from agrarian to an industrialised mining society definitely had an impact upon the old age population. With the transformation of society from an agro-based to mine-based, there occurred remarkable changes in the practice of agriculture too with which the old age population had to adjust. Prior to mining, agriculture was the uniform source of income. But of late, mining has seized the traditional source of livelihood making people dependent on mining related activities only. When the increased market price creates difficulty in fulfilling individual interests of earning members of family, they feel reluctant to feed their old parents. The productive unit which was responsible for providing all the basic amenities to all its members lost enthusiasm in taking the responsibility of the consumption unit who were not earning.

In mining affected villages the tendency of nuclear family is higher than that in control villages. The offspring's preferred to live in nuclear families rather to continue in the joint family system. So they tend to make their separate nuclear households leaving their parents. In many cases though they are living under the same roof still they preferred to cook their food in separate hearths. Moreover, the rural people of mining affected village became more calculative. This can be analysed by taking the following case study.

> Gobinda Sahoo is a 71 year old resident of New Khairkuni village. Prior to mining he was residing in the Khairkuni village. He was living with his four sons, daughter in laws and grandchildren. But the intrusion of Lakhanpur OCP displaced his family and now all his sons build up their separate houses in the New Khairkuni village. MCL has acquired all the agricultural and homestead land and provided the compensation as per the existing compensation package. All the four sons distributed the compensation money among them and decided to dine their father in a rotation basis. As Gobinda Sahoo is a landless person, he has no choice rather to accept the proposal of his sons. Now he is staying in each son's house for 2 months. When explaining the situation he recalled that once he was the head of his family and also the owner of 30 acres of land but now he has nothing in his hand. (Case 4.3)

The above mentioned case is not the only case of this region. Many more cases as that of *Gobinda Sahoo* are there where children of old parents are very indecisive to take care of them. In few cases it was observed that old parents nominated their children to get jobs in MCL on compensatory ground. For few years everything would be fine. But with time attitude of children would change towards their parents and later on would decide to opt out of the large family. They would move on to reside out of the family of their own, leaving parents and would even draw the attention of MCL authorities. Though there are lots of provisions in MCL rules to take action against those respective employees who have neglected their old parents, yet there has been no action taken as a measure to provide justice. Previously decision of a head of the household was considered as final and others would follow their judgement. But of late, the situation has taken quite a different turn. In a nuclear family the members take their own independent decision and they hardly consult their parents or grandparents regarding any issue or while taking any decision.

The rural communities of mining affected villages are found to be migrating to other villages and rehabilitation colonies. They exhibit little concern to take their parents with them and their parents feel reluctant to leave their ancestral habitation with which they are emotionally involved. Even in some cases few villagers have shifted to MCL quarters with their own children and wife, leaving their parents alone at village. In this case the old parents are becoming either wage labourers or are depending totally on Government *Bhata* (Old Age Pension). Previously, old age population had a strong hold in the village level decision making process. They used to participate in all social and political affairs of their village. But now the authoritative power has got transferred to the so called elite groups, i.e. political leaders, social activists, MCL authorities and the newly emerging contractor communities. At present these elite groups are taking all the decisions in the shadow of their own personal benefit and do not even bother to consult with the senior members of the respective villages.

In the control villages the situation is quite different. The old age population have their own significant roles constantly exercised in the decision making process of their villages. They continue to hold all the elite positions i.e. president of village development committee, secretary of Self Help Group and *Gram Sabha*. Though the

trend of nuclear family system is ripening still the importance of household head has its own importance.

4.4.2. Impact of Mining on Status & Position of Women Folk

The study of the social order will be imperfect without paying any attention towards the status and position of its women folk. Women hold significant position all through the archives of Indian history. But with the passage of time a visible decline of her status and position was marked during medieval and modern era (Nandal & Rajnish, 2014). The frequency of discrimination survives in the spheres of education, health care, physical and financial resources and prospects in the political, economic, social and cultural field (Das, 2013). However, the reason behind their degrading status is quite visible as they are underpaid, unrecognised and availing inadequate means of health and education facility (Mohiuddin, 1995). But the actual factor behind the discrepancy of women is the patriarchal society of India which refuses women category to take benefit of education, health care facility and active participation in decision making process (Banerjee, 2013).

In the mining affected villages the status and position of women is somewhat different. With the expansion of market economy women folk are availing monetary engagement in the nearby mines. Usually the SC and ST women are going out of the house and involving themselves in some mining related activities. When asked about their wage rate they revealed that they are received Rupees 120 per day while male members got Rupees 150 per day. So it is debatable that why a female labour is getting relatively lower amount in comparison to their male counterparts in spite of putting same effort and equal working hours? In fact the age-old practice of patriarchal superiority still holds its root even in the much developed industrialised economy.

Table No. 4.2: Family Support for Outside Work of Women

Mining Affected Village (Pre-Mining)		
Family Support	Frequency	Percent
Yes	64	21.3
No	229	76.3
Didn't Reply	7	2.3
Total	300	100.0
Mining Affected Village (Post-Mining)		
Yes	173	57.7
No	120	40.0
Didn't Reply	7	2.3
Total	300	100.0
Control Village		
Yes	19	19.0
No	75	75.0
Didn't Reply	6	6.0
Total	100	100.0

Source: Field Study

The above table declares the support of family members for women to work outside the house. Around 57.7 percent households of mining affected villages expressed their favour for women's autonomy and about 40 percent households replied that they don not support women's involvement in the economic activities. On the other side, the family support shows a sharp decline as majority of respondents of control villages denied women's entry into economic sectors. At the same time, 19 percent defendants approved women's autonomy through economic independency. But the pre mining scenario was quite different from both control and post mining phase.

A cluster of working women articulated that by becoming independent they were not only able to contribute in the family income but they also developed self-esteem among themselves. But the non-working bunch mentioned that the patriarchal pattern, jealousy and superstition of male counter parts were the factors which restricted them to involve themselves in certain economic activities. In the mining affected villages a majority of women communities were involved in *Bidi* making process. For one thousand *Bidi* they were earning 50-60 rupees and by practising this they could earn 600-700 rupees in a month. In addition, they were also making their presence felt in the local political bodies and educational institutions.

Though the women folk in the mining affected villages were empowered to a certain extent, they were not free from the issues like domestic violence, human trafficking and involuntary servitudes. At work place they faced mental and physical exploitation by contractors and fellow workers. Within four walls of their house they were beaten up by their spouses and in-laws. Their attempt to lodge a complaint against their oppression with Sarpanch or Naib Sarpanch of a panchayat fails as their position becomes more vulnerable with increased exploitation either by their spouses or by political leaders upon their complaint. Hence one may conclude that though women folk of mining-affected community availed certain economic independency yet they were not free from social and mental stigmas of the society.

4.5. Impact of Mining on Kinship System

Kinship system is a vital aspect of Indian social structure. Any research on Indian social structure will be incomplete without an appropriate description about kinship structure. The kinship system of a specific society provides a thorough understanding regarding the social interrelationships among its members. MacIver has pointed out that society is nothing but it consists of a "web of social relationships". But the social relationships are not same everywhere. Every society has its uniqueness in terms of its family system, caste structure, marriage pattern and also the kinship organisation. The kinship network has its origin in the family, encompasses the caste system and shields an identical zone (Koppad, 1972). The root of kinship system is biological as it defines the appropriate difference between a male and a female. Again it contributes several other biological relationships which are predetermined at a specified phase (Durbin & Saltarelli, 1967). The survival of a human individual necessitates the presence of some other folks who are connected either by marriage or blood. And the tie of blood and marriage which drags the individuals together is entitled as kinship.

Much before the arrival of mining, the traditional village structure was totally governed by the landlords. The rest engaged themselves either in agricultural fields or some household work of the landowners. Presently with the agricultural fields turning into mining fields, the system landlord embraced deterioration. So the process of in-migration and out-migration was introduced to avail better opportunities. As a result it paved the way for occupational mobility which in turn separated the entities from their kins. The individualistic attitude of the family members shifts towards neo-local family status from their joint family system. Even the consanguine kins feel reluctant

to provide a certain amount of financial aid to their other kins during crisis. Previously community members used to celebrate rituals and festivals together with their kins but at present they hardly celebrated any festival together. On the contrary, the residents of control villages explained that they have strong kinship ties and they support each other in situations of crisis situations also. The relationship between their kin members is more informal and they continue being together in social gatherings and through thick and thin.

4.6. Impact of Mining on Functions of Marriage

Marriage and family are measured as the basic pillars of Indian social structure. Marriage is a universally accepted basic social institution which becomes the ground to introduce the institution of family. It is an institution which draws several inferences and functions exclusively in a given set of social prerequisite. Though the pattern of marriage differs from society to society, still the basic aim is more or less same. Edward Westermarck in his *History of Human Marriage* outlines marriage as "the more or less durable connection between male and female lasting beyond the mere act of propagation till after the birth of offspring". Marriage as a social contract acknowledges men and women to begin a family life and injects definite privileges and obligations to have offspring. In this context Malinowski viewed marriage as a "contract for the production and maintenance of children". The view expressed by H.M. Johnson is of utmost importance. For him "marriage is a stable relationship in which a man and a woman are socially permitted without loss of standing in community to have children". The institution of marriage is deliberated to fulfil the biological needs in a socially sanctioned and legally permitted way. Duncan Mitchell's "A dictionary of Sociology" defined marriage as "a socially sanctioned sex relationships involving two or more people of the opposite sex, whose relationship is expected to endure beyond the time required for the gestation and the birth of children".

The above mentioned functions of marriage have undergone a makeover with the introduction of contemporary industrialised society. With the changing face of time not only the highly urbanised and modernised populace deliberate their views regarding the institution of marriage, but also the effect is reasonably observable in case of rural people. In the study site, the young kin are quite arguable regarding the

institution of marriage. Though they are not completely opposing the institution of marriage, still their opinion regarding the functions of this social union is somewhat different from the elder members of their respective families. This can be analysed from the Table No. 4.3.

Table No. 4.3: Respondents Response on Functions of Marriage

Mining Affected Village (Pre-Mining)		
Perception towards Marriage	Frequency	Percent
Social Bond	83	27.7
Religious Sacrament	200	66.7
Social & Economic Security	17	5.7
An Imposition	---	---
Total	300	100.0
Mining Affected Village (Post-Mining)		
Social Bond	136	45.3
Religious Sacrament	16	5.3
Social & Economic Security	145	48.3
An Imposition	3	1.0
Total	300	100.0
Control Village		
Social Bond	35	35.0
Religious Sacrament	33	33.0
Social & Economic Security	32	32.0
An Imposition	----	----
Total	100	100.0

Source: Field Study

The above table explains that, although there are modifications in every ladder of social institutions, still marriage has its own importance. The residents of mining affected villages are quite static regarding this societal unification. Previously attainment of religious sacrament was the prime focus in the hierarchical arrangement of marriage. But now people are more prone to establish a socio-economic security than religious security. The study reflects that 48.3 percent households considered marriage as a social security and 45.3 percent contemplated it as a social bond. While 5.3 percent household regarded it as a religious forfeit, a small bunch i.e. 1 percent of populace deliberated it as an imposition on them. But the situation is nearly same as before in case of control villages. Here community members are quiet possessive regarding religious aspects followed by social aspects. Marriage as an imposition is not at all a concept among them.

Prior to mining, equilibrium between marriage and society was well maintained by providing importance upon its religious aspect. However, the notion to achieve *moksha* (eternal bliss) and strong belief for the immortality of soul was given prior importance. But in the post mining era this perception has undergone a change. The mining affected people are giving importance upon socio-economic security rather than upon religious sacrament. Now-a-days the persons having permanent employment are preferred by the parents of brides to secure their daughter's future. Even the point of view of grooms is quite appealing in this regard. They are also in favour of marrying working ladies. Paradoxically, the growing market price and the unavailability of any permanent resources to sustain a livelihood are the major causes behind it. Mining affected populace is more rational to secure their socio-economic condition rather to achieve eternal bliss.

4.7. Impact of Mining on Marriage Pattern

Pre-mining society was very static regarding the institution of marriage. However, the pattern of marriage embraced the changes into a noticeable degree. After the intrusion of mining, the expansion of employment opportunity by the mining authorities was given prime importance to, as mining necessitates huge amount of workforce to achieve its target. As a result people from the nearby territories are migrating towards the mining hubs. In the whole process, the modifications in the spheres of cultural beliefs and social activities are taking place which is broadening the choice of marriage too. The attributes such as financial need of the family, decline of patriarchy, acceleration of economic dependency and thrust for socio-economic security provide flexible grounds to avail employment opportunities in case of women communities. Consequently, the interchange of thoughts and ideas are making women communities more empowered unlike before when only the male members were perceived as bread earners and women were simply restricted to household chores. In the present study the entire scenario has undergone sheer modification only after the introduction of mining industries. The process of cultural diffusion has widened the choice regarding marriage and the mining affected households are barely putting any restrictions on marriage patterns.

Table No. 4.4: Patterns of Marriage

Mining Affected Village (Pre-Mining)		
Marriage Pattern	Frequency	Percent
Arranged Marriage	287	95.7
Marriage by Choice	13	4.3
Total	300	100.0
Mining Affected Village (Post-Mining)		
Arranged Marriage	141	47.0
Marriage by Choice	159	53.0
Total	300	100.0
Control Village		
Arranged Marriage	69	69.0
Marriage by Choice	31	31.0
Total	100	100.0

Source: Field Study

In the post mining phase, people are more in favour of marriage-by-choice rather than marriage-by-arrangement (Table No. 4.4). But the situation was quite different in the pre-mining period. It was a time when the decision taken by household head was considered as final and other subordinate adherents were found to voice their opinions regarding their own choice of marriage. The breakdown of joint family system has decreased the importance of household head and now each individual is a distinct entity to employ his/her wishes. Though Indian Govt. placed restrictions on the age of marriage, the rural communities hardly followed the rule. They used to marry much before the attainment of government endorsed phase. But the post-mining phase is very instrumental in altering the whole heap of traditional boundaries. The adolescent folks are fairly mature now and they prefer to marry a person who is familiar with them rather to marry any unknown individual. The female candidates as well as their parents are now very particular in voicing their concerns with respect to their preference of candidature. The choice of groom purely depends upon their economic condition. Mere fulfilment of the basic criteria of a standard living is no more a wise concept now. Sometimes the economic determinant is also proving to be a false notion. This can be clearly exemplified by analysing some case studies.

In Darlipali village, Lalita Rahidas is a married woman aging 32. She is a daily wage worker and earns 120 rupees per day. She works under the supervision of a contractor in the nearby Lakhanpur OCP. She was into this profession since the age of 13. In the age of 16 she fall in love with the then contractor of Lakhanpur OCP and despite of several controversies she was able to marry that person at the age of 19. Though she was a single daughter of her parents even after marriage she continued to stay in her paternal family with her husband. But after ten year of her marriage, her husband left the village without informing anyone. The person did not come back even after three long years. When Lalita's family inquired about the person, they got to know that, the identity of their son-in-law was totally incorrect and not a single person is aware about his actual belongingness. Now Lalita is a mother of two children and still waiting for her husband to come back (Case 4.1).

Viredra Lohar works as a general majdoor in the Samaleswari OCP. He has three daughters and a son. His elder daughter got married in an arranged way five years before. At the time of marriage, Virendra has fulfilled all the demands of the groom's family. The groom was an operator in the same Samaleswari OCP. But after three years of togetherness, his son-in-law left her daughter by saying that she has some serious mental illness and she needs proper medication. According to Virendra it was absolutely untrue and his daughter is all okay. After a year of this incidence he came to know that his son-in-law remarried a girl and she is also working as clerk in the same OCP. Virendra Lohar has filed a police complaint against this injustice and is very hopeful about this indiscrimination (Case 4.2).

The above mentioned cases are displaying the negative side of marriage. With the advent of mining industries, the community is becoming economically proficient but at the same time they are going far away from their values and ethics. In the sway of industrialised economy the institution of marriage is losing its significance.

4.7.1. Caste Endogamy: Caste endogamy is a hereditary social division which follows certain caste based attributes. Most specifically it plays an important role during the institution of marriage. Nevertheless, the traditional Indian society gave utmost importance on the caste system but the industrialized era has witnessed significant alterations in this aspect. The present study witnessed a severe shift in this socially prohibited social division.

Table No. 4.5: Caste Endogamy and Preference of Marriage

Mining Affected Village (Pre-Mining)		
Preference of Marriage	Frequency	Percent
Within Caste	300	100.0
Inter Cast	---	---
No such restriction	---	---
Total	300	100.0
Mining Affected Village (Post-Mining)		
Within Caste	75	25.0
Inter Cast	116	38.7
No such restriction	109	36.3
Total	300	100.0
Control Village		
Within Caste	81	81.0
Inter Cast	19	19.0
No such restriction	---	---
Total	100	100.0

Source: Field Study

In the pre-mining period there are strict restrictions on caste endogamy during marriage (Table No. 4.5). Community members were bound to marry within their own caste groups. In almost all the households, members were marrying within their own caste. As the society was not much open, the choice for bride and bride groom was restricted within a specific locality. Marrying outside caste was considered sin and hampered the social status of a family. As most of the households were combined in nature, so no spouse was able to take a personal decision with regard to his/her marriage. However, the situation became different after the intervention of mining in the study areas. Mining which widened the scope for employment opportunities encouraged most of the outsiders to come and settled there. The inflow of outsiders created a cultural diffusion. With cultural diffusion, local people especially the younger generation started adopting the culture of outsiders. The rise of individualism, nuclear family, materialistic mentality, etc. motivated people to choose their own life partners. Only 25 percent households are stick to caste endogamy while others are quite open. Even in few cases it was observed that parents of grooms are not much reluctant with regard to marriage outside the boundary of caste. Some of them believed that as it is difficult to get a good salaried employee within their own caste and they have broken such caste restrictions. However, in case of arranged

marriage most of the people stick to their own caste. The situation in control village is more or less same as that of pre-mining phase.

4.7.2. Clan Exogamy: Generally, exogamy has a clear proximity with kinship system. In addition to this, clan ensures either patrilineal or matrilineal descent who cannot marry within their respective clan. Moreover, the community members used to put restrictions on its members during marriage. According to the culture of Western Odisha, patrilineal clans cannot marry within their own clans. But in the present study, this characteristic has undergone some visible changes.

Table No. 4.6: Clan Exogamy and Preference of Marriage

Mining Affected Village (Pre-Mining)		
Preference of marriage	Frequency	Percent
Outside the Clan	300	100.0
Within the Clan	---	---
No such restriction	---	---
Total	300	100.0
Mining Affected Village (Post-Mining)		
Outside the Clan	86	28.7
Within the Clan	34	11.3
No such restriction	180	60.0
Total	300	100.0
Control Village		
Outside the Clan	84	84.0
Within the Clan	16	16.0
No such restriction	---	---
Total	100	100.0

Source: Field Study

Unlike caste, clan exogamy was also there in the pre-mining phase. Almost all the households were adhering with the principle of clan exogamy during pre-mining period. But in the post-mining period restriction on clan exogamy hardly attracts any attention (Table No. 4.6). The rigidity in following clan exogamy is getting loosened. While only 28.7 percent households have stuck to this tradition, around 60 percent households have left it behind them. They are not so rigid towards clan exogamy. But majority households (i.e. 84 percent) in control villages still stick to clan exogamy.

4.8. Impact of Mining on Dowry System

The dignity of India lies in the backbone of its rich culture. And the cultural heritage delineates its stand by preserving the uniqueness of ethnic traditions and social practices. In India the unique ethos of marriage defines it as an auspicious ritual which not only secures as a bonding between two individuals but also ties up two distinct families together (Rawal & Singh, 2014). In the backdrop of marriage, forfeiting dowry is a customary recurrence since ancient era. Generally dowry means gifts in form of cash, ornament or any other wealth which a groom's family receives from the bride's side at the time of marriage. But the scenario has undergone a change. Dowry has now become a mere commercial deal where the groom's family impose upon the bride's family their material and monetary demands, giving it a shape of sheer exploitation. The increasing demand for dowry is continuously associated with infinite socio-economic issues and wide-ranging disputes. Every day, due to several tactics of physical and mental torture, used upon brides with an intention to extract more dowries, brides are forced to embrace death. The torchers are mostly bride's husband and her in-laws who have unsatisfied desire are called off upon the failure to meet the demands of the in-laws (Sachdeva, 1998, p. 301). So it is both a practice and a problem (Haveripeth, 2013). Though the position of women remains subordinate and their moral and financial dependency upon their male counter parts, forces them to tolerate all the cruelty meted upon them.

In the mining-affected villages prevalence of dowry is a popular issue. The individuals who managed to get a job according to the compensation package demand high dowries. Moreover, bride's parents readily offer high dowry in lieu of securing their daughter's future economically. Sometimes unemployed people used to get involved in the practice of demanding dowry regularly at short intervals looking it a source to extract money. But the situation was absolutely different during pre-mining phase. People had lesser degree of material and monetary anxieties. Prior to mining the income source was controlled by agriculture and some allied activities which had limited revenue. For that reason, the groom's family neither demanded nor were the bride's family in a position to fulfil their demand (Table 4.7). It was revealed by the villagers that marriage proposals that came from outside their blocks/districts demanded more dowries. As the region is an industrial hub of Odisha, people from

outside with a perception that almost all the villagers residing in this locality are rich and they can afford higher monetary and material demand.

Table No. 4.7: Status of Dowry during Marriage

Mining Affected Village (Pre-Mining)		
Status of dowry	Frequency	Percent
High Dowry	8	2.7
Left to the bride's home	249	83.0
No Dowry	43	14.3
Total	300	100.0
Mining Affected Village (Post-Mining)		
High Dowry	277	92.3
Left to the bride's home	7	2.3
No Dowry	16	5.3
Total	300	100.0
Control Village		
High Dowry	6	6.0
Left to the bride's home	82	82.0
No Dowry	12	12.0
Total	100	100.0

Source: Field Study

The above table shows that during pre-mining phase, dowry was not an important attribute. Nearly 83 percent respondents of mining affected villages did not consider dowry as an important part of marriage and according to them the decision of bride's home was accepted as final. While 14.3 percent villagers expressed their inconvenience regarding dowry, merely 2.7 percent villagers replied in favour of the practice. But this was the case prior to the establishment of mining industry. In the post-mining phase the practice of dowry has increased manifold. Around 92.3 percent of the populace were reported to have interest in dowry system. The reason behind this dramatic change is nothing but a gradual change in economic determinants. Traditionally, the bride's family used to give certain amount of gifts either in cash or kind as the girls had inheritance rights on paternal property. But the societal adherents have altered this process and are demanding an unusual amount of 'wedding gift' during the settlement of marriage proposal. This scenario has become popular in the post mining phase.

On the other hand the control village households were very lenient regarding dowry. For them the bride's family remained the sole authority to decide whether they would

be able to give any kind of wedding gift or not. Near about 82 percent households described that it is purely a choice of bride's family and 12 percent households did not even show any interest in dowry system. For them an individual is going into the institution of marriage only after attaining the basic requirements of a family, so why should they take any financial and material assistance from their in-law's family.

4.9. Impact of Mining on Caste System

The caste system in India is a system of social stratification which historically separated communities into thousands of endogamous hereditary groups called *jati.* It is a hereditary endogamous group whose membership is well-defined by birth not by selection or by accomplishments. Neither there was any control over it nor was any supremacy entertained to change the process. In this regard Anderson and Parker explained that, "Caste is that extreme form of social class organisation in which the position of individuals in the status hierarchy is determined by descent and birth"[6]. The caste system has its origin in the '*Chaturvarna'* system. According to the *Chaturvarna* guideline, Hindu society consists of four major *varnas* viz. the *Brahmins* (priests & teachers), the *Kshatriyas* (warriers & rulers), the *Vaishyas* (farmers, merchants & artisans) and the *Shudras* (servile labourers)[7]. Being in the highest ladder *Brahmins* used to hold supremacy and they were also called as the ruling caste. The *Shudras* were treated as untouchables and they did not have any right to enter into the temples or other public places. Despite the release of Untouchability (Offences) Act, 1955, which prescribed severe punishments on the preaching and practice of untouchability, the people were reportedly determined enough not to give up their so called social dignity.

Each caste ensures some kind of peculiarity by the practise of its individual customs, traditions, practices and rituals. It abides by its own principles and guidelines such as the '*caste panchayats'* were there to control the misdeeds of its members. Undeniably 'the caste is its own ruler' (Siddaramu, 2013). But the scenario is totally different in the mining affected villages. The competition for attaining a better class has ruined the age-old tradition of caste system. Likewise, the caste based occupations are not in

[6]Bhushan, V. & Sachdeva, D. R. (2005).*An Introduction to Sociology*.Kitab Mahal Agencies, Allahabad.
[7]Rao, C.N.S. (2001b). *Primary Principles of Sociology with an Introduction to Social Thought* (Third). New Delhi: S. Chand & Company.

practise at all. Previously the *Brahmins* had the only right to teach but now even the scheduled caste and scheduled tribe people are working as teachers in the *Anganwadi* centres and in the schools either at their own or in the nearby villages. At the same time the weaver does not weave anything and the *Kamars* (blacksmith)hardly practise farming or any other manual labour works.

The habit of taking '*pakka*' and '*kachcha*' food has also lost its impression[8]. During the study it was observed that the upper caste people too, attend social functions of lower castes and have the same food along with others. Somehow, the concept and practice of untouchability, where a lower caste person cannot touch a person of higher caste even in case of emergency, has absolutely disappeared. Social restrictions on marriage used to prohibit a person to marry outside the caste. In case of inter-cast marriages, the caste panchayat was in the habit of assigning severe punishment both to the married couples and their families. But of late, records of inter-caste marriages (38.7 percent) can be found in the mining-affected villages where they hardly found any objection for it (Table No. 4.5).

Caste system has its rigidity in the selection of occupation. During pre-mining phase, the society was predominantly based on agriculture where the role of different castes was well defined. Every caste group had their pre-defined occupational restrictions and they need to restrict themselves within its structural boundary. Due to the structural aspect of society, every caste was dependent upon each other for the fulfilment of their respective needs. However, with the introduction of mining, a new ray of alternative source of livelihood arrived. Along with the loss of agriculture, it has entirely disturbed the age-old tradition of caste system. Right to choose the occupation is a popular philosophy now. Though a majority of people avail either permanent or contractual jobs in the mine sites, sometimes the increased market price forces them to involve in some subsidiary income sources such as chicken/duck rearing, tailoring, vending, *bidi* making etc. During field work it was observed that in the mining affected villages irrespective of their caste almost all women are engage themselves in *bidi* making activities.

[8]*Pakka* food denotes the food cooked at ghee and *kachcha* food means the food prepared with the use of water. This was the practice among the Brahmins of North India. They used to accept *kachcha* food only from the upper castes and *pakka* food from the castes which had lower strata in the society (Rao, 2001c)

Sophisticated earning, better living standard and improved economic condition became a trend among the mining affected communities. Sometimes they worked hard to achieve the above mentioned conditions while at others they involve themselves in certain activities that are socially and legally restricted. So the concept of class based society is in the process of replacing the caste based society. When mining affected communities are running behind the class based society, on the other hand, the respondents of control village were found to be more generous towards caste based society. The social stigma of caste system is still a practice among the residents of control villages. Although caste-based occupation still prevails but the idea of taking *kachcha* and *pakka* food is no more in practice. Even the restriction on practices of the inter-cast marriages are persists.

4.10. Impact of Mining on Traditional Power Structure

Power is an important aspect without which it is almost challenging to define Indian social structure. It holds a strong authoritative control of the members of a definite society. Further, the functioning of a group depends on a strong and authoritative exercise of power. In rural India, always the power flows from the upper to lower ladder. Traditionally, the power was centralised among the landowning and upper caste communities. In a rural set-up ownership and control over land draws the real sketch of the term power. Along with land ownership, caste and class are also measured as indispensable mechanisms of socio-political status and power[9]. J.B.P. Sinha in his study of "Power in Indian organisations" revealed that, "Power is the capacity to influence others" (Sinha, 1982).

MacIver argued that "By the possession of power we mean the capacity to centralise, regulate or direct the behaviour of persons"[10]. However, Michel Foucault has given an absolutely contradictory statement. For him "Power is exercised rather than possessed. It is not essentially repressive or coercive but it can be productive. Power does not flow from a centralised source but also flows from the bottom up, that is,

[9] Beteille, A. 1969, *Changing Patterns of Stratification in a Tanjore Village*, University of California Press Ltd., London, England.
[10]Bhushan, V & Sachdeva, D. R. (2005b).*AnIntroduction to Sociology* (Second). Allahabad: Kitab Mahal Agencies.

from the multitude of interactions at the micro-level of society"[11]. But power is not a constant attribute. It changes with the process of social change. In this regard Marx defined power as "the faculties, abilities and capacities of people". For him human powers are not simply what they are now, but also what they were historically and what they can be in the future under changed social circumstances[12]. Power can be exercised to control the activities of its subordinates and it can implement any change at the time of requirement. Max Weber defined power as "the ability to control the behaviour of others, even in the absence of their consent"[13].

Prior to the intrusion of mining activity, in the mining affected villages, the *Brahmins* and the OBCs had authoritative power as they held large amount of land. They used to take all the decisions of their respective villages. The posts like Sarpanch, President and Vice-President of village development society etc. were predominantly acquired by the *Brahmins*. But a shift was marked after the imposition of mining industry by MCL. The present study reflects that in mining affected villages, the *Brahmins* are not the landowning castes and they hardly have any authoritative status and power. It is evident from Table No. 3.23 that except Kudopali (18 percent), Ubuda (2 percent) and New Khairkuni (10 percent), there is no general caste household in other studied mining affected villages. Before mining activities these general caste communities were mostly the land holding households in the studied villages. Most of them lost their agricultural lands because of mining. As part of the compensation process most of them received good amount from MCL. Only after losing their land and subsequently the remittance of compensation they preferred to migrate to nearby resettlement colonies and in some cases to urban areas. In New Khairkuni village migration from nearby Tingismal and Banjhipali villages is very frequent. As a result of migration processes the other caste groups gets an opportunity to play a dominant role in the decision making process of their respective village. As a result the OBCs, SCs and STs jointly hold authoritative power.

[11] Doshi, S.L. 2009, *Modernity, Postmodernity and Neo-Sociological theories*, Rawat Publications,Jaipur.
[12]Ritzer, G.1996, *Sociological Theory*, The McGraw-Hill Companies, Singapore.
[13]Rao, C.N.S. (2001d). *Primary Principles of Sociology with an Introduction to Social Thought* (Third). New Delhi: S. Chand & Company.

All the residents are not fortunate enough to avail compensation packages as most of them were landless farmers. Previously they used to work in the agricultural farms of the dominant households and they were bound to follow authoritative power of their landlords. This system got replaced with the advancement of mining industry. Now the contractors are playing the role of landlords and the inhabitants are required to follow the footsteps of these newly emerging contractor communities for the accomplishment of economic essentials.

Every society needs a leader to treasure the fruit of success. In the mining affected villages a small cluster of considerably educated leaders were allegedly involved in the 'right to procure' movement. The marginalised people have deep faith on these leaders. But those so called front-runners are not trustworthy at all. Most of the time it has been observed that these so called leaders have become cosy with the MCL authorities for their personal benefits and as a result the vulnerable sections have become clown in the hands of both the MCL authorities and their own leaders. So here the MCL authorities are procuring the authoritative power over the village dwellers in a quite bewildering manner.

From the above discussion it is clear that, in mining affected villages the term 'power' is centralised and dependent only in the hands of few dominant classes rather than with the traditionally dominant landowning castes. In contrary to this scenario, the traditional power structure of control villages continues to be controlled by the upper caste population. The landowning upper caste populace hold authoritative power in the villages. They also abide by the principles and guidelines put forth by the caste panchayats.

4.11. Mining and the Changing Scenario of *Jajmani* System

The complete understanding of economic activity among the rural communities of India can be traced out by observing the multifaceted and interchanged workforce. Undeniably, village community of India that has agriculture as its dominant source of livelihood projects peculiar characteristics. However, all the rural community a whole could never become the proprietors of agricultural land. Therefore they had to depend upon certain skilled and unskilled mechanisms to earn their living. It was in exchange

of their service to the few landed proprietors that received a precise share of goods (Gould, 1958).

The rural economy of India was purely caste based. Caste system was buoyantly conceived by the rural people as a means of their social resilience. The customs, traditions, rites, rituals, rules, restrictions, show a discrepancy from caste to caste. The situation was apparent that each caste group ought to follow their hereditary occupation. With the hierarchical arrangement of caste system every caste group were not only bound to follow their hereditary occupation but they were required to provide service to other castes on diverse societal situations. Such a process of interdependence has been specified as '*Jajmani* System'. In this regard Oscar Lewis rightly pointed out that "under this system each caste group within a village is expected to give certain standardized services to the families of other castes" (Lewis & Barnouw, 1956a).

The *Jajmani s*ystem denotes economic characteristic of the caste system (Bahl, 2004). It is a hereditary form of relationship between the patron and client which recognised division of labour between the castes. Customarily, the members of each caste group followed their hereditary occupation i.e. the son of a black-smith becomes black smith and the son of a barber serves the members of *jajman's* family in every social and religious ceremony.

Jajmani system was regarded as the pillar of rural economy. The word '*jajmani'* has its root in Sanskrit literature. It is derived from *yajman* which means the one who offers a sacrifice and the term '*jajmani*' denotes the entire connection (Mayer, 1993). Further the *Jajmani* system is considered as a patron (recipient) and client (service provider) relationship between the caste groups. In this system the family or family head who receives a particular service from his client is known as his *jajman* and the person who provides the service to his *jajman* is known as *kamin*. The distinguishing feature of this system represents a structure which functions without a considerable exchange of money and the relationship between the *jajman* and *kamin* does not represent the picture of employer and employee in a capitalistic system (Lewis & Barnouw, 1956b).

The *jajmans* were the landowning caste groups who also influenced the political system of a particular village. On the other hand, the *kamins* were the landless communities and usually were involved in the rituals associated with polluted occupations. While doing the research on *The Hindu Jajmani System* at *Sherupur* village of North India, Herold Gould exemplified seventeen structural features of Hindu *jajmani* system which he borrowed from Wiser's study of "The Hindu *Jajmani* System". They are 1) free residence site, 2) free food for family, 3) free clothing, 4) free food for animals, 5) free timber, 6) free dung, 7) rent-free land 8) credit facilities 9) opportunity for supplementary employment 10) free use of tools, implements and draft animals 11) free use of raw materials 12) free hides 13) free funeral pyre lot 14) casual leave 15) aid in litigation 16) variety in diet and 17) healthful location. These are the characteristic features which the *jajmans* provide to their *kamins* in exchange of their service (Gough, 1960; Lewis & Victor, 1956b).

Prior to mining, the *jajmans* were on the one hand the landowning and ruling communities while on the other the *kamins* were the service providing landless communities. But the acquisition of agricultural land by mining communities has ceased the entire role of *jajmans*. With the decrease of agricultural land, not only the *jajamani* system has lost its structure, but has also embraced eye-catching alterations in the structure of rural society. In the present study the change in the structure of *Jajmani* system was observed very closely. The change in the structure and function of *Jajmani* system can be analysed by employing the three tier relationship developed by James Learch (1983) and Mishra (2008) in their respective studies of rural Orissa. The three tier system was replicated here as they resemble the present study at Ib valley coalfield. They are:

- Change in Landlord-*Purohit* Relationships
- Change in Landlord-Service *Jati* Relationships
- Change in Landlord-Agricultural Labour Relationships

4.11.1. Change in Landlord-*Purohit* Relationships

The residents of mining affected villages replied that prior to the intrusion of mining activity they had a close-knit relationship with the *purohit* system. A *purohit* is a

person who nurtures religious activities of a *jajman's* family and in turn receives an amount of *Dakshina* in terms of kind or cash. But this exchange system has been totally changed in the shadow of mining. Displacement induced by mining has certain negative impacts on the reduction of this system. However, due to mining the landlords have lost their agricultural lands and this has disturbed their *Jajmani* relation.

As mining has already acquired agricultural land and there has arrived a purely market based economy, the importance of *purohit* has declined completely. The then landlords have now found employment in the field of mining. Even the *purohit* community is no more dependent on the landlords as they have nothing to get from land lord in terms of grains. Some of them engaged themselves in other economic activities for their survival. In Kudopali village it was observed that, the *Dixit* (*Brahmin*) communities were once the *purohits* but presently they have stopped practising their traditional form of occupation. Even they have become rich occupants of this village now. As a result, no *purohit* visits his *jajman's* house for collection of annual payment of grains. However, the central intention of this relationship is still continuing. Though the *purohit* from the same family is not invited but some other *purohit* gets an invitation at the time of ritual. However, payment in kind is mostly replaced by cash.

4.11.2. Change in Landlord-Service *Jati* Relations

Changes in the landlord-service *Jati* relations are very prominent in the mining affected villages. Previously the relationship between the landlord (patron) and service providing (servant) *jati* was very natural. The traditional service providing *jatis* were Barber (*Bhandari*), Blacksmith (*Kamara*), Washerman (*Dhoba*), Carpenter (*Badhei*), Potter (*Kumbhara*), Gold smith (*Sunar*) etc. These caste groups used to provide service to the patron households.

With the initiation of mining, the landlord service *jati* relation has been disturbed. Only 1.3 percent of *Bhandari* (barber) community were found in mining-affected villages. However, they have stopped practising their traditional occupation as before. They too have engaged themselves in certain other mining related activities. Therefore, it takes a lot of effort to persuade a barber to attend ceremonial activities

and provide service. In addition they have become more demanding. The blacksmith are the traditional smithing community. They used to exhibit their skill in iron works. With the advancement of mining industries almost all the mining-affected villages have lost agricultural land. Hence, the need for blacksmith in order to prepare different agro-based equipment has declined. Not a single household in mining affected villages was reported to practise this profession.

The traditional occupation of carpenter was to show their proficiency in wood work. Their source of livelihood was totally dependent on preparing and repairing of wooden objects. Previously, they used to prepare plough and furniture for their *jajmans*. However, with decrease in the practise of agriculture very few farmers have been left to confine their profession. Besides the few tillers of land mining have taken to modern methods of farming such as tractors and power-tillers. The use of plough therefore has become scarce in the mining-affected villages. On the other hand, people are heading more towards physical assets like modern furniture that do not support traditional equipments either in its production or in its maintenance. Again, the scarcity of timber products has compelled the people to directly purchase the equipment rather than to engage a carpenter to construct it.

Similarly, the traditional relationship between goldsmith and landlord, washer men and landlord, potter and land lord, etc. has entirely disappeared from the mining-affected villages. The customary occupation of the goldsmith was to pierce the ears and nose of the women members of their *jajmans*. They too provided the gold ornaments at the time of marriages and birth cycle rituals. But with the expansion of market economy the village communities are purchasing gold ornaments from jewellery shops who are also efficient enough to pierce the ear and nose upon payment of cash. At the same time, not a single washer man household was reported in the mining-affected villages. They had occupied special position much before the initiation of mining but according to the present study, it was observed that they have totally been wiped out of late. Usually washer man community was accustomed with the cleaning of clothes of their *jajmans* and had a special role to play in the ritual practise of marriage, birth and death. As almost all the households have lost their agricultural lands, washer men no more visit their serving households to collect annual grain payment called *varshika*. While the non-ritual services rendered by these

service castes like *Dhoba* and *Barika* do not constitute a part of the *bartan* (annual payment) relationship, grain payments have invariably given away to cash payment, their service monopoly during rituals are never compromised. In case of control village these relationship still existed but not in traditional form. Though the cash has taken the place of grain, still payment in terms of grain continues to certain extent.

4.11.3. Change in Landlord-Agricultural Labour Relationships

A significant change occurred in the landlord-agricultural labourer relationships. Prior to mining, just like in control villages agricultural labourers were found to provide their services by working in the agricultural fields of the landlords. The relationship between the landlords and agricultural labourers revolved around secular activities and ritualistic activities. They had a kind of patronage relationship between them. Apart from wage, landlord used to provide their agricultural labourers with free food, clothing and other required items at the time of need. The situation is quite different in case of mining affected villages. Except Ainlaplai, Kantatikira and Ubuda villagers, others were forced to leave agricultural activities after MCL took away the cultivated land. Due to scarcity of agricultural lands most of the households were forced to adopt non-agricultural occupations. Moreover, the villagers who still are in practice of agriculture as a source of income generation face labour problem because the agro-labourers have now been engaged as wage-labourers in adjacent mines and coal washeries. They are presently able to generate their permanent income from mining related activities and hence feel reluctant to work in the agricultural fields for its seasonal nature. Besides, whoever desires to work in agricultural fields demand a higher labour price. Though blasting is a continuous process and it leads to physical damage of houses, it has become very difficult for the villagers to arrange labour force to repair their houses. So the present day relationship is no more a patronage kind of relationship rather purely contractual.

Table No. 4.8: Prevalence of *Jajmani* System

Mining Affected Village (Pre-Mining)		
Prevalence of Jajmani System	Frequency	Percent
Yes	277	92.3
No	7	2.3
Didn’t Reply	16	5.4
Total	300	100.0

Mining Affected Village (Post-Mining)		
Yes	9	3.0
No	275	91.7
Didn't Reply	16	5.3
Total	300	100.0
Control Village		
Yes	37	37.0
No	63	63.0
Total	100	100.0

Source: Field Study

The above table (No. 4.8) indicates that nearly 91.7 percent households of mining affected villages stated that they are not practising *jajman-kamin* relationship and only a small bunch i.e. 3 percent households were reported of continuing the relationship because the needs of a barber or a priest still persists in certain ceremonies and rituals. At the same time, 5.3 percent of the households did not reply anything regarding the issue. Here the valid percentage shown is of the households that had responded to the enquired question. However, prior to mining the practise of *Jajamni* system was much popular among the mining-affected communities. While majority (97 percent) of the households gave their views upon the practice of it, only 5.4 percent respondents remained silent. On the contrary this system was quite prevalent during the pre-mining period. Whereas the control villagers reported that no doubt some structural changes have occurred in the practise of *Jajmani* relation still the functional impact of it continue to show of its own significance.

It is pretty clear from the above discussion that with the arrival of mining giant the traditional *Jajmani* system has disappeared. The outset of kind i.e. land, cow, grain etc. as a mode of payment has been replaced by cash. Expansion of market economy, loss of agricultural lands, mechanisation of agriculture and introduction of contractual labour system has brought about both the structural and functional changes among the rural people of mining affected villages. Although in a skeleton form, yet the *Jajmani* system has continued to be existing in notion among mining affected communities. Contrary to this, the residents of control villages were reported that they were much in the practise of *Jajmani* system. The control villagers have also tasted the changes in the structural aspects of the system but its functional aspect still remained with them as it was before.

4.12. Impact of Mining on Fairs and Festivals

Observation of fairs, festivals and rituals, upholds an essential prerequisite to preserve the cultural heritage. In the absence of these distinctive features, a culture will get weakened and the exclusivity of human civilization will be compressed. Rituals and ceremonies are the carriers of a sacred thread which ties the individuals into a strong bond. However, it puts importance on the historical elements and sometimes places its stand on the remembrance of some ancient characters or the implementation of spiritual entities. So it endures the responsibility of a transporter which is capable of carrying the information regarding the history of an object, legendary figures, habits and practises, folklores and mores, mythologies and so many other attributes. For instance, the famous *Durga Puja* Festival in India has a mythological base. The sacredness behind the celebration of this festival is not only a social get-together but is the rememberance of the antiquity. According to the mythology, Goddess Durga, the manifestation of *Shakti* (the power) took birth to get victory over the demon king *Mahishasura*. All the Gods combined their powers and invented *Shakti* to defeat the demon king to provide protection to the universe. However, she not brought victory but also destroyed the evil power. Hence, people of India celebrated this festival to remind them of the incident of the past which had brought victory of evil. Likewise the folks were in the habit of practising many more rituals and festivals throughout the year. Although the customs and carnivals differ from region to region, every society preserves them in a sustained mode.

Each part of India represents a distinct cultural practise. Similarly the state of Odisha has its peculiarity in practising several rituals and festivals all through the year. Again there is a region wise observation of various ceremonial activities. In the present research the study area is located in the western part of the state. The western part of this state is rich with cultural uniqueness. During the field visit it was observed that prior to mining the villagers were engaged in various kinds of agro-based festivities such as *Nuakhai, Pausha Purnima, Lakshmi Puja* and many more. Starting from the sowing of seeds to the ripening of yields they were connected with various religious rites and rituals in a cyclical process. And they have proper justification regarding the celebration of these festivals. The people of Ib valley usually celebrated two types of festivals i.e. community level festivals and household level festivals.

4.12.1. Impact on Community Level Festivals:

The popular community level festivals which the residents of Ib valley celebrates are *Nuakhai, Pausha Purnima, Gokulastami Jatra, Rasa Purnima, Naam Yangya and Ranjta Festival.* All the above mentioned festivals have both historical and mythological base. But the interference of coal mining in to this region has ruined the traditional cultural practises. As most of the villagers moved from place to place because of displacement they lost their social coordination to organise those festivals. As long as the source of income was nature based villagers used to observe various festivals to appease Gods and Goddess to save their source of livelihoods from various natural calamities. As they lost agricultural land due to mining, the agro-based rituals and festivals lost their charm and the previous essence regarding the observation of festivities. All the residents of mining-affected villages replied that they were not observing the festivals in the same spirit as it was before. Further they added that the ancestral worship of their village deity has lost its significance too. Along with all these factors as mining brought a permanent source of livelihood for the villagers, their faith and dependency on God and Goddess have got reduced. This can be analysed from the Table No. 4.9.

Table No. 4.9: Reasons behind the Non-observance of Festivals

Mining Affected Village (Post-Mining)		
Reasons	Frequency	Percent
Absence of Unity	10	3.3
Absence of Agro-land	125	41.7
Development of individualistic attitude	51	17.0
Migration	114	38
Total	300	100.0

Source: Field Study

The above table describes the reasons behind the non-observance of community level rites and festivals among the mining-affected communities. It is worth to mention here that, all the households of control villages practise all kinds of regional rites and festivals. Even the mining affected residents replied that they were in practise of all kinds of rites and festivals much before the initiation of mining industry. Therefore in this case, only the current scenario of mining affected villages were analysed

minutely. The majority of residents i.e. 37.7 percent mentioned that the absence of agricultural land has separated them from their traditional customs and ceremonies. With the intrusion of mining a materialised culture cropped-up among the mining affected communities and a major chunk of the population migrate towards cities and other resettlement colonies. Sometimes the mining authorities forcibly displace groups of people and compel them to settle in to other places. In this situation the unity for observation of rituals and festivals is affected drastically. Around 38 percent households replied in favour of migration and absence of agro-based land, followed by 17 percent for the development of individualistic land and 3.3 percent opined that the absence of both unity and we-feeling is compels them to isolate from the rituals and ceremonies.

Even though some of the rituals and festivals are in practise but they no more observed in the same way as it was before. Despite of various causes, the community members still practise the community level festivals.Though *Nuakhai* and *Lakshmi Puja* are purely agro-based festivals yet the landless people try to procure the paddy from other villages and perform the rites and rituals accordingly.

4.12.2. Impact on Household Level Festivals:

Except the above mentioned community level festivals, the residents were also in practice of some household level festivals such as *Savitri Brata, Bhai Jiuntia, Lakshmi puja* etc. After the intrusion of mining activities though the community level festivals have adversely been affected, the household level festivals are still in practice. However, these festivities have their own significance and at the same time it has nothing to do with agriculture. When asked about the festivities most of the young folks were found to be unaware regarding their own traditional festivities as they are not in practise today. The festivals are mostly related to agriculture and agro-based communities. As mining has acquired agricultural lands and also forcefully displaced the communities from their traditional lands, the community cohesion has got disturbed. As a result the structures of the agro-based festivals have lost its importance.

Even there is disappearance of folk festivals and folk dance which had its own importance during pre-mining period. So the query regarding sustainability of these

few rituals and festivals is a matter of concern now. On the other hand, the villagers of controlled group revealed that they observe their traditional rituals and festivals with lots of ecstasy and wholeheartedly involve in the arrangements and celebrations of community level festivals.

4.13. Impact of Mining on Community life and Social Security

The interrelation and integration of a group of people gives birth to the idea of a community. A community is a natural cluster where the members are connected with each other who share a common way of life. The solidarity among the members of a particular community plays a vital role in sharpening the cohesiveness among its members. However, the first and foremost goal of a community is to achieve victory over individualism. Blaire E. Merca pointed out that "A human community is a functionally related aggregate of people who live in a particular geographical locality at a particular time, share a common culture, are arranged in a social structure and exhibit an awareness of their uniqueness and separate identity as a group"[14]. In the same way Bogardus defined community "a social group with some degree of 'we-feeling' and "living in given area"[15]. From the above definitions it is quite clear that every community have their distinct realisms and it is the responsibility of its members to continue the exclusivity and discrete uniqueness. Similarly a strong sense of unity among the community members results in such a way that every individual feels a sense of stable belongingness with their shared attributes. So both the individual and the community are complementary to each other.

The above mentioned prerequisites of a community have revealed a severe deterioration among the mining affected communities. The idea of community life is declining in its importance. Normally each element of rural community was interconnected with some established structure of rules, regulations, values and principles which symbolise a community life. The continuity of these attributes depends purely on the representation of all the social groups in a collective way. But the hierarchical arrangement of caste system and unequal distribution of power are the interruptions which need to be overcome for active participation and collective action.

[14]Bhushan, V. & Sachdeva, D.R.. (2005c). *An Introduction to Sociology* (2nd ed.). Allahabad: Kitab Mahal Agencies.
[15]Bhushan, V. & Sachdeva, D. R. (2005d). *An Introduction to Sociology* (2nd ed.). Allahabad: Kitab Mahal Agencies.

In spite of being an insignificant unit (only 4 percent) the *Brahmins* still hold all the dominant positions in the villages like Kudopali, Ubuda and New Khairkuni. On the other hand despite being a dominant category i.e. 46.25 percent (Table No. 3.3) in terms of population, the Scheduled Tribes as that of the General Castes and the OBCs lack to attain dominance in their villages. Prior to mining the Brahmins were the landowning castes and owing to this reason they dominated the social and political system of the entire village. But the situation has undergone a slight change. It was reported that except the above mentioned three villages, the representation of SC and ST communities in the social, economic and political affairs is gaining its importance.

The community centred division of labour was an important aspect of agrarian society. Each member of a community was assigned certain prescribed work which maintained the equilibrium in the society. Then people were connected with each other out of their common goal to achieve a certain goal. But in the post-mining era people have become self-centred. They have developed individualism to procure a better economic condition rather to continue with their fellow members. However, the deviation from agro-based livelihood also has made them to deviate from their old social and communal practices. The rituals and festivals which they were accustomed to celebrate jointly have shown a sharp decay. Even the ancestral worship of their village Gods and Goddess have revealed a sharp decline.

A modification in the aspect of leisure time work of the community members is also an important feature of the mining affected communities. When interacted, the residents of mining affected villages explained that before mining they used to spend their leisure time by interacting with the elder and other fellow members of their village. And most of the time they used to discuss about the developmental aspects of their village. They also added that it was fun to work unitedly with the village development committee. But now all these activities have disappeared and they prefer to do their own household work and watch TV.

Prior to mining the upper caste communities dominated the whole system and after the intrusion of mining newly emerging upper class groups have ceased control over it. However, with increased market structure the dependency ratio has decreased and the community members are voluntarily taking part in many economic activities.

Most of the time the competition to obtain a better living condition with the current market price has given birth to a number of socially and legally restricted actions like black marketing, prostitution, juvenile delinquency, child labour, theft etc. The community that once played the role of a saviour for the protection of social values, customs, rules and protocols has lost its significance of late.

Contrary to the above state of affairs, the situation of the control villagers is quite appealing. They still have a strong faith on the customs, traditions, rites, rituals etc. The community members are jointly working for the development aspects of their respective villages. According to them the society of likeness is dominating over the society of differences. But it is the caste hierarchy that represses them to enter into the socio-political spheres of community life. In fact the community life of the control villagers is quite better than that of the inhabitants of mining affected villages.

4.14. Shift of Social Solidarity and Transformed Social Structure

In his first book *The Division of Labour in Society* Emile Durkheim has discussed about the theory of Social Solidarity. He perceived two ideal types of society i.e. mechanical solidarity and organic solidarity. Mechanical solidarity signifies the solidarity of resemblance where a identical group of people share a common value system, emotions, sentiments and many other uniform beliefs and ideas. Being a product of likeness it embraces strong collective conscience. In the present study it was quite clear that prior to the intrusion of coal mining the residues of mining affected village were emotionally involved with each other. They used to practise common ideas, principles and have a common philosophy regarding their exclusivity. The communal feeling was the most basic attribute to generate social cohesiveness. So the pre-mining society symbolizes all the characteristic feature of mechanical solidarity. On the other hand, organic solidarity indicates the solidarity of dissimilarity. In this society every individual has a distinct uniqueness and they gave importance to individualism rather than to orthodox philosophies. The above mentioned similarity was apparent in the post-mining society. Here the villagers considered them as individual members and preferred to establish their individual identity. Similarly, the transformation in the structure and function of family system, alteration in the pattern of marriage and disintegration of community life are the characteristic features of organic solidarity. So the present study undoubtedly accepts

the theory of social solidarity as it has an empathetic justification in this specific perspective.

4.15. The Weak Ties of Social Structure

The Strength of Weak Ties is a pioneering work of Mark S. Granovetter for the study of social network. The primary aim of this network analysis theory is to project how the interpersonal ties are tied with each other and up to what extent the micro level phenomena such as diffusion, social mobility, political organisation and social cohesion are related with it. For Granovetter the "strength" of a tie can be analysed by observing the amount of time, the emotional intensity, the intimacy and through the reciprocal services. According to his observation there are two ties i.e. strong tie and weak tie. Granovetter analyses, while on the one hand strong ties are interrelated with each other through greater occurrences of above mentioned attributes, on the other hand the weak ties are considered to have subordinate manifestations. In the present study it was observed that the community members of mining affected villages are weakly tied with each other. The change in structure and function of family, the intrapersonal kinship relation, the transformed *Jajmani* system and power relation, non-observance of rituals and festivals and discontinuity of community relation are the factors affecting the network ties between the mining affected communities. According to the present network analysis theory change in one aspect of society affects the other aspects. Though the members are not strongly tied with each other in the community, the network structure enters in to secluded factions. However, prior to mining the communities were tied with strong interpersonal ties that influenced the whole structure of their society. But presently we find a sheer deficit of collectiveness among the mining affected communities. While agreeing with the theory the researcher can conclude that as the strong ties i.e. family, marriage, kinship etc. of the mining affected communities have lost its strength they represent a weak tie in the practise of social networking.

4.16. Conclusion

The modifications in the context of rural social structure have taken place since the intrusion of coal mining project in Ib valley. As change in one aspect influences the other aspects, so transformation in the structure of all these aspects brings alterations in the functional aspects. Although, the institutions of marriage, family, caste system, power relation and *Jajmani* system remain in practice, yet they have lost their traditional base and persist only in skeletal form. While, the traditional power structure was being replaced by the contractors and by the so called front-runners of vulnerable sections, the economic aspect of caste system i.e. *Jajmani* system disappears. At times, dowry which is considered as a social evil is becomes popular among the employed communities. Even significant modifications become visible in the observance of agro-based fairs and festivals. So it can be concluded that mining has negative impact on the rural social structure in Ib valley.

Although negative, the impact usually begins with disturbing the primary units of society and continues to distress the aspects such as livelihood, environment, health etc. However, to execute this resource extraction industry, enormous amount of direct impacts (positive/negative) upon the local communities and their livelihoods is felt. Therefore, the next chapter attempts to measure the impact of coal mining on the rural livelihoods of Ib valley by employing sustainable livelihood framework of DFID.

Chapter-V
Mining and Rural Livelihoods

5.1. Introduction

Mining has witnessed a virtuous symbol of economic activity especially in the developing countries. By introducing this resource-extraction industry, the unindustrialised realms are earning substantial section of foreign exchange and at the same time subsidising obviously to the growth of gross domestic product (GDP). Though the spill over of mining operation is enriching the health of a country's economy, on the other hand, it bestowed a wide range of harmful bearings on the local people and their livelihood (Appiah &Buaben 2012; Kitula, 2006). However, the situation varies from country to country as every region has its own agro climatic zone which outlines definite pattern of livelihood practises. In the context of India, the resource rich regions were highly underdeveloped until the institution of this restructured development projects i.e. mining. The new mining projects necessitated massive acres of land to execute their operation and started convincing the people by providing a better income earning environment as well as the infrastructural developments like well-connected roads, electricity, health care facilities etc. Still the mining projects appear equally unplanned as it produced various negative outcomes such as displacement, migration, diverse aspects of pollution, inadequate share of welfare measures and so on.

Moreover, mining incorporates some sort of direct impacts (positive/negative) on the local communities and their livelihoods. Although economic transformation is gaining its space, at the same time it is deviating from the aspect to protect the livelihood of project affected people. In the globalized era, mineral exploration is considered as one of the central economic activity which necessitates sheer transformation of rural households too. But sometimes this agenda sprigs to encompass the targeted rural people as it is centralise on the hands of bourgeois class only. To be very precise, the fruit of development cannot be fortified by overlooking the source and means of living of the project affected communities. Appropriate measures are indispensable to safeguard the livelihood in a sustainable way.

Livelihood embraces the capitals and resources needed for the human population to delineate a living. Its factual features compact the people, their skills, aptitudes and mostly the means of living, which comprises food, income and assets. Again it can be termed as sustainable (environmentally and socially) when it enriches both the local and global resources which govern the livelihoods, and at the same time constructs supplementary sources of revenue. Meanwhile, it can improve stress and shocks as well as preserve it for imminent cohorts (Chambers and Conway, 1991a).

5.2. The Archives of Sustainable Rural Livelihood (SL)

The endeavour of Sustainable Livelihood (SL) was proposed to overcome the orthodox description of poverty eradication. It made an effort to deliberate the features like vulnerability and social exclusion which can either restrain or augment the aptitude of the deprived sections, to establish a meaningful living in an economically, ecologically, and socially sustainable approach. So the SL model forecasts a kind of rational and analytical outlook towards poverty (Krantz, 2001a).

The assembly of three words 'sustainable', 'rural', and 'livelihoods' was first introduced in the year of 1986 by the Advisory Panel of World Commission on Environment and Development (WCED), while preparing the report for Bruntdland Commission entitled Food 2000 (Scoons, 2009). During the discussion session, M.S. Swaminathan, Robert Chambers and others proposed an idea about people-oriented development and they placed rural poor in the centre of development (Swaminathan et al. 1987). So the report on Food 2000 brought together the concepts like stock and flow of basic human needs, security on ownership of resources, sustainable agricultural practices and poverty into one frame. Simultaneously, this report considered SL as a combined effort towards poverty, sustainability, livelihood formation, and participation of poor, which in turn punctuated the foundation of SL approach (Cahn, 2002). The WCED definition on SL is as follows:

> Livelihood is defined as adequate stocks and flows of food and cash to meet basic needs. Security refers to secure ownership of, or access to, resources and income-earning activities, including reserves and assets to offset risk, ease shocks and meet contingencies. Sustainable refers to the maintenance or enhancement of resource productivity on a long-term basis. A household may be enabled to gain sustainable livelihood security in many ways – through ownership of land, livestock or trees; rights to grazing, fishing, hunting or gathering; through stable employment with adequate remuneration; or through varied repertories of activities (WCED, 1987).

Until December 1991, maximum debates on SL had its move towards rural zones. In the same year, in a working paper of Institute of Development Studies (IDS), entitled *Sustainable Rural Livelihoods: Practical Concepts for the 21st Century,* Robert Chambers and Gordon Conway made a modification on earlier definition of sustainable livelihood and recommended the following operational definition of sustainable livelihoods (Krantz, 2001b; Solesbury, 2003)

> A livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living; a livelihood is sustainable which can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation; and which contributes net benefits to other livelihoods at the local and global levels and in the short and long-term (Chambers and Conway, 1991b).

The above mentioned definition of livelihood is regarded as the most renowned definition of sustainable livelihood as it stresses its prime focus on household level. Even it can also be applied to measure the welfare and access at an individual or intra-household level along with its wide ranging application on the extended family, the social group or the community. The anatomy of a household livelihood consists of two repertoires i.e. people and activities, and also entails two portfolios i.e. assets and outputs. Among the portfolios, the tangible and intangible assets are the most complex category. The portfolio of tangible assets includes stores (e.g., food stocks, stores of value such as gold, jewellery and woven textiles, and cash saving in banks of thrift and credit schemes) and resources (e.g., land, water, trees, livestock, farm equipment). Among the intangible assets it shields claims (e.g., demands and appeals which can be made for material, moral or other practical support) and access, which is the opportunity in practise to use a resource, store or service or to obtain information, material, technology, employment, food or income are the most complex assets. In the midst of these tangible and intangible assets the rural communities used to practise one or more varieties of livelihoods by employing their own knowledge, skill, physical labour and sometimes through education and experimentation (Chambers and Conway, 1991b).

An accurate distinction was made between environmental sustainability and social sustainability. Environmental sustainability refers to the external impact of livelihood on local and global level resources and on both tangible and intangible assets. Social sustainability refers to the internal ability of a livelihood to bear up external burden. It

can also cope with stress and shocks as well as it can assure the capability to adapt the change. The human livelihood found vulnerability in two phases i.e. stresses and shocks. While stress is continuous and cumulative, it predicts the situations like seasonal shortage, rising population, declining resources etc. On the other hand, shocks are usually impulsive and unpredictable such as fires, floods and epidemics. Hence, livelihood can be sustainable when it not only indulges itself to avoid the endeavour of shocks and stress but also can cope with them for its recovery (Chambers and Conway, 1991c)

5.3. Execution of SL Approach by Donor Agencies

Ever since the familiarity of SL approach by Chambers and Conway, the approach was adopted through different government and non-government agencies with insignificant variances. During early 1990s, the organisations like CARE, OXFAM, UNDP and DFID started employing SL approach in their study of poverty, sustainability, livelihood security, participation of poor etc. Even some other organisations are also working on SL approach. But the above mentioned four organisations have significant contribution for the development of SL approach.

Since 1993, OXFAM GB is endorsing sustainable livelihood under the guidance of Koos Neefjes. Basically it has applied the SL approach in the aspects of development and emergency relief. Its strategic policy on 'Right to a Sustainable Livelihood' considers economic and environmental equity and sustainable livelihoods for future generations. Even it pays attention to the context of health, education, life security and equity. OXFAM's SL approach affords importance on four prospects of sustainability (Hussein, 2002a):

- Economic (markets/credit)
- Social (networks/gender equity)
- Institutional (capacity building, access to services and technology, political freedom)
- Ecological (quality and availability of environmental resources)

In 1994, CARE International started employing the SL approach while undertaking varieties of development and relief programmes for the poorest and vulnerable sections. Under its Household Livelihood Security (HLS) programmes it undertakes

the endeavours like programme analysis, design, monitoring and evaluation into its framework. By borrowing the HLS concept from Chambers and Conway, it denotes the following fundamental features of SL:

- Possession of human capabilities (education, skills, health, psychological orientation)
- Access to tangible and intangible assets
- The existence of economic activities

On the basis of these three attributes one can identify the strategy for a household. Though it places more emphasis on poor people to prepare themselves in the direction of a secure livelihood, it stresses its concentration on personal empowerment and social empowerment too (Krantz, 2001b).

In 1995, UNDP adopted SL approach under its Sustainable Human Development (SHD) programme. The SHD covers poverty eradication, employment and sustainable livelihoods, gender, protection and regeneration of environment, and governance. UNDP's sustainable livelihood approach widely covers the Poverty and Environment Initiative (PEI) and has a narrow application on policy levels (Hussein, 2002b).

In 1997, DFID formally adopted the SL approach on its '1997 White Paper on International Development'. In this assertion it gave emphasis on poverty elimination in poorer countries and promotion of sustainable livelihoods.

However, it is quite clear from the above discussions that the term livelihood endures a wider implication and at the same time the need of its simplification is an obvious occurrence. Owing to this, the present study was being analysed by adopting the framework developed by DFID. Generally the framework was developed to assess the livelihood of rural poor, and the present study was undertaken in a rural set-up. For that reason the present research bears its significance to ascertain the livelihood of mining affected rural communities.

Coal mining has traumatic influence on the livelihood of rural population at Ib valley coalfield. Though it is accountable for the infrastructural and material development of the region, still the alarming calamities like loss of income earning opportunity, displacement, demolition of natural resources, degradation of biodiversity,

deterioration of health etc. can never be welcomed. The material growth cannot be fortified by undermining the socio-cultural, natural and environmental disruptions. And at the same time the concept of sustainable livelihood cannot exhilarate its true stuff by sticking out with one side interpretation only. Henceforth, the necessity of an in-depth assessment was sensed. Basically, after assembling these fundamental statistics, a detailed analysis was made by employing the SL approach developed by DFID.

5.4. Sustainable Livelihood Approach by DFID

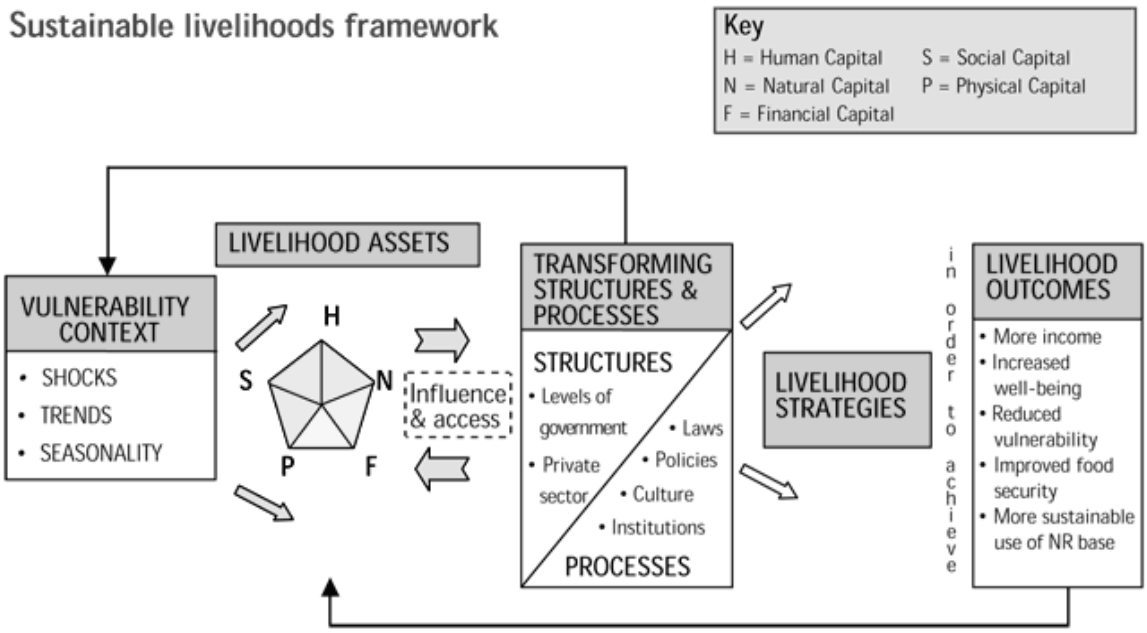
Though a range of SL approach was developed and familiarised by number of development agencies, the SL approach developed by DFID is widely popular for the planning and implementation of development programs.DFID's SL approach has its basic root in the Chambers and Conway's definition of livelihood. As per DFID "A livelihood comprises the capabilities, assets and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base". The SL approach warranted that, beneath this framework people can came across numeral livelihood products which in turn provide them assistance to preserve the assets and can abbreviate their annoyance. However, the approach revolves around six core principles i.e. people centred, responsive and participatory, multi-level, partnership, dynamic and sustainable. But the central principle of this approach is people centred.

As the prime objective of this approach is to eliminate poverty, it points its essence in the vulnerability context which is regarded as the external environment of the inhabitants. Generally the vulnerability circumstance is being governed by three factors i.e. shocks, trends and seasonality which have direct impact on people's belongingness. The present research reinforces its significance in and around the mining affected villages where the mining affected communities are practising several economic deeds to sustain their livelihood. So the vulnerability context in this research is mining which has a kind of direct (positive/negative) impact on the attainment of capital assets. The circumstance is quite natural that the mining affected villages are in the receiving end of mining merchandises and their livelihood assets are gathering transformation. However, the alteration in the livelihood assets can be

analysed in five segments by means of employing five core capitals of SL framework. This SL framework comprehends five basic core capitals i.e. human capital, natural capital, financial capital, physical capital and social capital. Though in one hand, these core assets influence the transformation of structures and processes but on the other hand it intends to secure a varied livelihood strategy which perpetuates the accomplishment of positive livelihood outcomes.

In the livelihood framework Human Capital stands for the skills, knowledge, ability to labour and good health which facilitate the people to embrace divergent livelihood strategies for the attainment of their livelihood objectives (DFID, 2000). Natural Capital denotes the natural phenomenon which radiates the commodities to sustain life. Besides this it also acquaints with all the natural resources like land, air, water including the unabridged gamut of all the living organisms on earth. It is also intended for the complete financially viable drive of all human being (IISD, 2008). Natural Capital can be perceived as renewable or active natural capital and non-renewable or inactive natural capital. While the renewable or active natural capitals (i.e. nutrient cycling, ecosystem etc.) uphold the viability due to its recycling process, at the same time, non-renewable or inactive natural capitals i.e. fossil fuels and mineral deposits are passive in nature (Costanza and Daly, 1992).

Figure No: 5.1: DFID's Sustainable Livelihoods Framework



Source: DFID's Sustainable Livelihoods Guidance Sheets

According to the Business Dictionary, the word Physical Capital deals with the tangible assets which is the product of human intervention. It consists of the basic infrastructure and producer-goods such as roads, affordable transport, adequate water supply, clean and affordable energy and access to information which are indispensable to sustain the livelihoods. Financial Capital directs the economic wealth which helps to accomplish the livelihood objectives. It can be achieved through available stocks (i.e. cash, bank deposit, livestock, jewellery etc.) and regular inflows of money which includes pensions or else some additional rearrangements on or after the state and remittances. In the SL framework Social Capital embraces the social resources such as collectively acknowledged rules, norms, sanctions, networks, trust, reciprocity and co-operation for the quest of livelihood objectives. Above all these resources are interrelated with each other and have direct impact on livelihood (DFID, 2000).

5.5. Mining& Rural Livelihoods

The discussion about the impact of mining on rural livelihoods cannot be assessed by scrutinizing its contribution towards national development. The narration regarding 'national development' advocates the involvement of government and non-government organisations, elite groups, mining bodies and local inhabitants. However, the first three categories are mutually employing and executing their strategies, guidelines and diplomacies through widespread advocacy, while the local residents are flattering as impact bearers only. Up to certain extent the infrastructural and material development is achieving its universe but the entire array of development is distressing the local livelihoods from different perspectives. The principle of rural livelihood not only reinforces the economic gain but it also stresses its association with human, natural, physical and social determinants too. So the present research is an attempt to determine the endeavours regarding diverse impacts (positive/negative) of coal mining on the livelihoods of project affected people at Ib valley coalfield by employing Sustainable Livelihoods Framework of DFID.

Up to the commencement of mining industry the entire rural region of Ib valley coalfield was structured by agrarian activities. A major chunk of local residents were in practice of agro-based actions for their subsistence. Even they were accustomed with the local forests to yield the MFPs. But the entire scenario is undergoing a

process of transformation since the origination of mining. IB valley's mining history dates back to the invention that took place at Himgir Rampur Colliery in 1909. But the entire fertile land turns out to be unproductive and unprofitable with the introduction of opencast mines since 1984. So the present chapter will analyse the following aspects:

- The type of diversified economic activities with which the local communities are accustomed with during pre and post mining phase.
- Assessment of both positive and negative outcomes of mining on local livelihood.
- Mining and the issue of sustainable livelihood.

5.5.1. Vulnerability and Diversified Rural Livelihoods

The vulnerability context of SL approach cannot be overlooked while unfolding the rural livelihood aspect of Ib valley coalfield. As mentioned earlier, in the present study the vulnerability context is mining and the diversified impact of mining is considered as an exogenous factor for the livelihoods of rural communitiesAt the same time mining activities are considered as positive propagators in the direction of income generating engine. Though the rural region of Ib valley is entirely designed with coal therefore, it is boosting the mining giants to generate more and more income earning sources.

Diversified livelihood is a rational response of the households when they fail to generate income from the primary source of livelihood. But in most of the time while the vulnerability situation occurs, the rural households used to engage themselves in multiple off-farm economic activities i.e. day labour, charcoal making, transfer of funds etc. (Iiyama, 2006). Ellis defined Rural Livelihoods Diversification as 'the process by which households construct a diverse portfolio of activities and social support capabilities for survival and in order to improve their standard of living'. Livelihood diversification encounters the orthodox insights regarding poverty reduction of the rural poor. Logically, the rural households practise varied farm activities through crops and livestock. But the true fact is that in most of the time lots of poor small scale farmers are unable to produce secure livelihoods from crop and

livestock production. So the prevailing situation forces them to recreate alternative sources of livelihood (Ellis and Allison, 2004).

The major source of livelihood in the Ib valley coalfield is mining. As the expansion of mining wings had already been taken away the productive agricultural lands, the local residents are entirely relying on the mining activities to sustain their livelihood. Though agriculture was in practise much before the initiation of mining, it has lost its significance in the ostensible mining era. Although mining is a profitable economic activity still it lacks the guarantee of utter occupational portfolios. But the rural residents are so adapted with the vulnerability situation that they are instrumental to carry out varied livelihood assortments. So, the present section analyses the diversified livelihood strategies being practised by the rural people of Ib valley coalfield. It also tries to give a snapshot calendar regarding the pre-mining phase as well as draws a perpetual comparison between the mining affected and control villages. Table No. 5.1 pronounces the diversified sources of livelihood at Ib valley.

However, it is inevitable to mention that the income earning sources are the basic pyramid to construct sustainable livelihoods. But when a single source of livelihood fails to tackle the prerequisite of households, the emergency of diversified sources of livelihood derives. Table No. 5.1 clearly depicts the varied income earning sources of the respondents of both mining affected and control villages. During the post mining phase in all the mining affected villages majority of the respondents (51 percent) were uttered their liability regarding their primary source of income from the mining sectors. Logically, this category of respondents was actually provided employment against their loss of land for mining. But the situation was entirely different all through the pre-mining phase when majority of households were in practise of agriculture. While comparing the situation with the control villages, it was observed that agriculture is still holding its significance among the mainstream respondents. On the other hand, once the agricultural season is over the villagers are in a habit of occupying themselves in some kind of non-farm activities.

Around 17 percent households in control villages are continuing dairy and other allied activities as major source of livelihood. Though the above said activities were assigned to the villagers of mining affected villages much before the mining era, they lost their significance by the enactment of mining giant. So an alteration in the cradle

of enduring a livelihood is observed in case of mining affected villages. Around 26.7 percent respondents are engaged as unskilled non-farm wage labourers who were hypothetically regarded as agricultural labourers in pre-mining phase. However, most of the cultivable lands were already taken by MCL and the rest are filled with coal dusts and waste particles which creates an uncertain environment for agriculture. As a result, the mining affected population is stirring towards non-farm sectors. While the rural populace of control villages are all set to grind as casual labour, the deficiency of occupational prospects in the neighbourhood ambiances has narrowed down their action towards farm sectors.

Table No. 5.1: Diversified Sources of Occupation

Primary Sources	**Mining Affected Villages**		**Control Villages**
	Pre-Mining	**Post-Mining**	
Agriculture	196 (65.3)	-----	38 (38)
Horticulture	10 (3.4)	-----	3 (3)
Agricultural Labour	44 (14.6)	-----	15 (15)
Skilled Wage Labour	7 (2.3)	21 (7)	5 (5)
Unskilled Non-farm Wage Labour	8 (2.6)	65 (21.7)	2 (2)
Employment (Pvt. Sector)	2 (0.6)	23 (7.7)	6 (6)
Employment (Govt. Sector)	1 (0.3)	8 (2.7)	2 (2)
Trade/Business from fixed Premises	3 (1)	27 (9)	7 (7)
Dairy & Allied	20 (6.7)	-----	17 (17)
Mining	------	153 (51)	-----
Others	9 (3)	3 (1)	5 (5)
Total	300	300	100
Secondary Sources	**Mining Affected Villages**		**Control Villages**
	Pre-Mining	**Post-Mining**	
Agriculture	-----	32 (10.6)	2 (2)
Common Property Resources	167 (55.7)	-----	40 (40)
Unskilled Non-farm Wage Labour	-----	8 (2.7)	12 (12)
Fishing & Allied	97 (32.4)	-----	19 (19)
Goatery/Other animal rearing	20 (6.7)	-----	6 (6)
Vendor	9 (3)	13 (4.3)	4 (4)
Shopkeeper	5 (1.7)	21 (7)	3 (3)
Beedi Making	-----	186 (62)	-----
LIC Agent	-----	9 (3)	-----
Rents (House/other assets)	-----	27 (9)	-----
Others	2 (0.7)	4 (1.4)	14 (14)
Total	300	300	100

Source: Field Study
Note: Figures in the pa

Source: Field Study
Note: Figures in the parenthesis are percentage

But the employment in government and private sectors is increased both in the mining affected and control villages. In compare to mining affected villages (i.e. 7.7 percent in Govt. & 2.7 percent in Pvt.) a minimal difference was found in the realm of control groups (i.e. 6 percent in Govt. & 2 percent in Pvt.). Likewise, the income from fixed assets of trade/business is more in the mining affected villages rather than in the control villages. So it is worth mentioning that the establishment of mining industries is providing the atmosphere for commercial doings. Dairy and other allied activities were in practice during pre-mining era and it has lost its importance in the post mining phase. But the residents of control villages are still continuing the same.

As it is clear from the above said discussions, during the vulnerability occurrence, the rural communities turn out to be instrumental in the adoption of diversified livelihood portfolios. But when they became unsuccessful in coping with the situation by practising varied primary occupational sources, they used to embrace several secondary means of support. In the present research a vast majority (i.e. 62 percent) of mining affected households have indulged themselves in *beedi* making followed by 10.6 percent in agriculture, 9 percent in collection of payments from house and other assets, 7 percent as shopkeepers, 4.3 percent as vendors and 3 percent as LIC agents. Apart from this, around 2.7 percent households are working as unskilled non-farm wage labourers and 1.4 percent households are involved in different types of self-employed activities such as tailoring, betel shops, and cycle repairing shops.

During pre-mining era, the villagers used to get some fixed income from common property resources (CPR). However, with the introduction of mining it has lost its relevance. The common lands were converted into mining plots. With the expansion of mining projects, CPR activities along with allied activities such as animal rearing are highly disturbed. At the same time a whole new category of LIC agents have been emerged. The process of in and out migration has introduced this section of active community. In the mining affected villages though the earning is much better along with life threatening repulsions, it is very easy for the LIC agents to run their business industry by delivering motivated counselling among the vulnerable unit.

On the other side, the control group of population are still gaining a portion of income from common properties. Both the villages are surrounded by natural resources like

river, forest, and mountains etc. which are proving beneficial for the villagers. Talapatia village is located on the bank of the river Ib, so the residents of this village are reportedly involved in fishing and after accomplishing their own requirements they used to sell it in the nearby village market. Even the availability of abundant natural forests is approaching them to carry out animal rearing. This can be analysed by taking the following case study.

> Mohammad Abdul Ali aging 59 is a permanent resident of Talapatia village. Primarily he works as an agricultural labour in his own and also nearby villages like Saletikira. As agriculture is a seasonal practise in the study area, it was not at all sufficient to run the household of five members. Although the other members of his family are contributing towards the family income and expenditure, still Ali is acquainted with animal rearing. Once the agricultural season is over, he has the habit of collecting goats and pigs from his fallow villagers and takes them to the nearby village forests for their fodding. It is a daily activity for him during non-agricultural season. At present he is rearing 30 goats and 10 pigs and in return he gets 30 rupees per one goat or pig. This occupation is not providing him the amount he used to get during agricultural season but for him it's a great support which aids assistance during inedible periods (Case 5.1).

The introduction of mining has not only enriched the source of revenue for Govt. but has also increased the source of livelihood for local communities both directly and indirectly. It has attracted lots of outsiders into its periphery to work either as permanent or temporary workers. However, the flow of immigrants has created a scope for the localites to introduce new sources of income. While few have given their house on rent, the others have started new business to meet the increasing demands. The inflow of migrant workers and contractors has increased the demand for rented houses in Darlipali, Kudopali and Kantatikira villages. It has also created some opportunities for the marginal households to sell local alcohols as well as coals by stealing it from nearby mines.

From the above assessment, it is clear that diversified livelihood strategy explains the varied income generating sources but rural livelihood cannot be assessed by shading concentration only on income earning structures. Diversified source of sustenance is not at all a whole new approach. It was developed by the rural people much before the industrialised era. But the only difference between pre and post mining phase is the accessibility of wide-ranging profitable prospects. Although mining has broadened the

realm of cost-effective industry and even the local residents are embracing this line of track, still the demolition of natural vegetation, community forest, healthy environment, social connectedness etc. are conveying the uneven circumstances to sustain a livelihood. So a detailed analysis regarding the impact of mining on livelihood assets will probably bring the exact scenario (positive/negative) of Ib valley coal field.

5.6. Mining and Livelihood Assets

The livelihoods approach delivers its apprehension on people. It revolves round achieving an accurate portrait regarding people's response on the stock and flow of capital endowments. Basically, this approach was instituted to measure the differential livelihood outcomes through an array of livelihood assets. The assortment is necessary because on the basis of a particular asset it is difficult to evaluate the entire structure of development process. So the framework ascertains five categories of assets to evaluate both positive and negative livelihood outcomes. In the present section the researcher will focus on the impact of mining on five core capitals of SL approach.

5.6.1. Impact on Human Capital

As stated earlier in the sustainable livelihood framework, human capital denotes the skills, knowledge, ability to labour and good health which empower people to cultivate different livelihood strategies in order to execute their livelihood objectives (DFID, 2000). The enactment of mining brought several luxurious ingredients to develop a people friendly environment in the direction of its march. But the stuffs are not universal to accommodate the need of each vulnerable entity. As an interim measure it has provided employment to each entitled household and at the due course of time overlooked other peripherals in the direction of policy aspect. The instance of any assistantship towards the landless communities was entirely deficient.

5.6.1.1. Health and Health Care Facility

However, in the context of health care facility, the central hospital of Ib valley is providing entire facility to the employers of MCL only and no such provision is made to look after the non-employees. As a result they are consulting only with the medical

practitioners of community health centres. The prevailing diseases of the mining affected regions are gastrointestinal, malaria, arthritis, TB, eye-allergy etc. Of them there are some daily occurring diseases i.e. gastrointestinal, eye-allergy, arthritis and skin diseases. The cases of TB patients are high in Kudopali, Kantatikira and Ubuda villages. Even the emission of coal dust and the radiation of heat from the mines as well as from the movement of coal loaded vehicles are causing irritation all over the body. The villagers of all the mining affected villages reported that they are having skin diseases all over the body and the children are getting affected more. The Table No. 5.2 is displaying the frequently occurring diseases of both mining and non-mining regions.

Table No. 5.2: Prevalent Diseases[16]

Items	Mining Affected Villages		Control Villages
	Pre-Mining	Post-Mining	
Households Affected	187	300	76
Frequently Occurring Diseases	Normal fever, cough & cold, headache etc.	Gastro-intestinal, skin diseases, eye-allergy, TB, malaria, arthritis, diarrhoea etc.	Normal fever, cough & cold, headache etc.
Seasonal Diseases	Malaria, measles, diarrhoea, skin diseases etc.	Measles	Malaria, skin diseases, measles etc.

Source: Field Study

The Table drawn above (No. 5.2) shows that, in the mining affected villages prior to mining the diseases such as normal fever, cough and cold, headache etc. were the frequently occurring diseases. But in the post-mining phase all the sample households are experiencing gastrointestinal, TB, high BP, diarrhoea, eye-allergy etc. very frequently. There were some seasonal diseases such as malaria, skin diseases, measles, diarrhoea etc. in the pre-mining phase. Though measles are seasonal diseases, still the reason of frequently occurring diseases is mining only. However, the non-employees are coming across more issues as they are not entitled to avail the medical opportunity of MCL. At the same time the community health centres are not sufficient enough to provide all kinds of treatments. So the non-employees are mostly visiting the nearby TRL hospital for medical emergencies and are paying for their

[16]Detailed information regarding the diseases and its occurrences was given in Chapter No VII.

medications. But the lower income segments are quite repugnant to bump into the medical cost and often becoming extinct as they hardly can bear the medical expenses.

On the other hand, the control villages are found minimal health issues. Moreover, they are coming across some seasonal health problems like malaria, measles and skin diseases. These health evils are generally occurring during the rainy seasons. In general, normal fever, headache, cough and cold are the frequently occurring diseases which need no such significant attention.

5.6.1.2. Education

Besides good health knowledge bears one of the important aspects of human capital. But this aspect is immensely mistreated in all the mining affected villages. As per the residents of mining affected villages, MCL is not undertaking any initiative to improve the deceitful occurrences of illiteracy. As it was given in the Table No. 3.5, during the post mining phase, the percentage of illiteracy has come down in comparison to pre mining period. However, during pre and post mining phase, the percentage of illiteracy is high among the Scheduled Tribes (STs). But there is a variation during these two phases, because in the pre mining period 59.8 percent STs were illiterate but in the post mining period it came down to 33.6 percent. In the pre mining phase, out of 22 Scheduled Caste (SC) households, 40.9 percent were illiterates but in the post mining stage it also came down to 18.2 percent. Remarkable variation was also perceived in the context of Other Backward Castes (OBCs). Their literacy rate also came down to 7.2 percent in comparison to pre mining stage. But the literacy rate was higher among the landowning general castes. As the general category were the landholders as well as they hold the prestigious position in society i.e. priests, president of *gram sabha*, *sarpanch* etc. they had access to education. Even those who went for higher education were mostly belonging to the general and OBC communities. On the other hand, the SC and ST communities who were economically deprived and landless had not received education more than matriculation. However, during post-mining period, around 9.8 percent ST had more than matriculation qualifications. But during post mining period, no such significant change was observed in case of SC communities.

The disparity was found not because of the direct impact of mining but up to some extent the economically well-off categories are availing this opportunity by disbursing their own cost to pursue education. Even it was observed that the mining affected villagers are paying much interest towards earning rather than wasting their time in schools. The most prominent reasons behind this are as follows: at first, prior to mining, unavailability of educational institutes hindered them to pursue education and the post mining phase pulls them to earn rather than restricting to formal education. At second place, the current market price is forcing both the parents to earn and while both of them are going out, their children are either taking care of their other siblings or stealing coal from the nearby mining sites. Third reason behind this is the irregularity of school teachers. Although all the mining affected villages are falling under the neglected zones, so any inquiry team merely comes to inquire about the smooth functioning as well as children's attendance in the respective schools. This can be analysed by taking the following case.

> Harihara Rahidas ageing 42 is a resident of Darlipali village. According to him both he and his wife are daily wage labourers and are working under the contractor of Lakhanpur OCP. After a daylong work he is earning 150 rupees and his wife is getting 120 rupees. They have four children and no one is going to school. They have already registered two of their children's name in the primary school of their own village. Every day by morning 8 AM the Rahidas couples are going out for work and in their absence the elder one is stealing coal from the nearby LOCP and the second one is taking care of her younger siblings. Though the parents are aware about their children's activity, they are hardly looking into this aspect as they need to earn to at least feed their children twice a day. (Case 5.2)

The above mentioned case is not only the case of Rahidas couples of Darlipali village, but many more cases are available to justify this exploration. Even the same villagers are not at all agreeing to register their children's name in the middle schools as the nearest middle school is located at Gumadera which is 9 kilometres away from this village. However, the situation in control village is quite different. Though both the middle and primary schools are available in both the villages under study, the villagers got easy access to educate their children. As it was given in the Table no. 3.10, among the literate category, higher percentage of villagers is having primary education. Specifically in the case of marginal communities such as SC and ST, the percentage is 41.6 percent 27.3 percent, which is quite high. Similarly, around 33.3 percentage of ST are having middle level education. But the villagers' representation

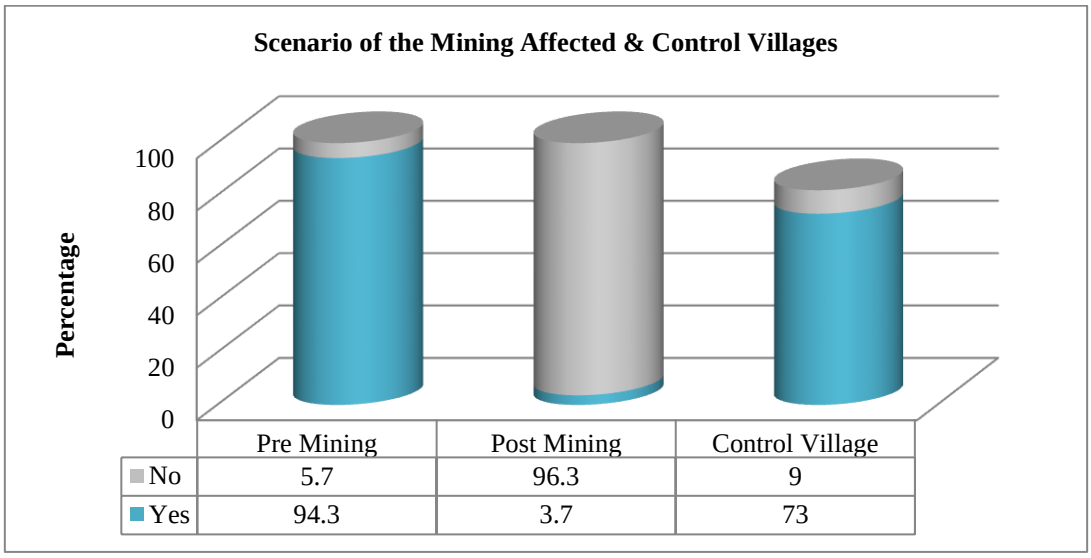
in higher education is very low. As most of them are not economically prosperous and depending on agriculture, they never bother about higher education. During field study it was observed that only four percent villagers are matriculate and one percent is having post matric qualification. The scenario is more or less similar with pre mining phase. It was found that, only 8.3 percent households possessed matriculation degree and 2.33 percent had post matric qualification degree during pre-mining period (Table No. 3.10).

However, the scenario has embraced a change during post mining phase. As per the fixed criteria of MCL, they are looking for minimum matriculation degree for any official job, so the residents have developed an interest to have that degree. During field survey, it was observed that, not even a single household is having any interest to send their children for higher education. They were found to be crazy for matriculation degree and up to some extent diploma degree, as their ultimate aim is to get a job in MCL. Hence, the overall situation of mining affected villages shows that the craziness to get a job in the mining sector have improved the educational standard of the villagers. And it has ultimately helped in improving the human capital.

5.6.1.3. Skills and Knowledge

Next to education, skills and knowledge are other important components of human capital. Up to some extent the working communities possess some skills to exhibit it during their work. Basically, the working communities are the land owners who lost their tenancy land due to mining and in return became employees of MCL. But they didn't possess any skill to work in the mines. Then the provision was made to train them regarding their respective works. But no such provision was made to train the non-working communities who are equally vulnerable. According to the Resettlement and Rehabilitation Policy of MCL, only one member of each entitled family is getting the employment opportunity. Further, the other members of family who have equal rights on their tenancy land are neither getting any employment benefit nor trained for any other activities to sustain their livelihoods. It was already discussed in the previous chapter that mining has ceased the traditional caste based occupations where every caste had their own expertise knowledge and skill to exhibit as well as to practise that for livelihood generation. This can be analysed from the following figure (No. 5.1).

Figure No. 5.2: Possession of Traditional Skills & Knowledge



Source: Field Study

It is clear from the Figure No. 5.1 that, prior to mining the affected households were in practise of traditional skills and knowledge to generate livelihood opportunities. But in the post mining phase, the age-old skills have lost their significance. Even MCL is not taking any initiative to endow any professional training. The mining affected communities have already lost their caste based and land based engagements and in the absence of any new opportunity, they are becoming more vulnerable.

The discussion clarifies that, though assurances were given to the mining affected villages to provide them appropriate training skill to generate alternative income sources, they remain assurances only. Rather the villagers are passing through varied health issues and also are developing dogmatic attitude towards money rather than good health and education. This discussion makes it clear that mining has absolute negative impacts on human capital.

5.6.2.Impact on Physical Capital

Physical Capital indicates the basic physical features and moderately amalgamated fabrication which formulates to endure a livelihood. As per DFID the basic physical elements to sustain a livelihood includes affordable transport, secure and shelter buildings, adequate water supply and sanitation, clean affordable energy and access to information (ibid, 2000). In the present study the impact of mining can be assessed by throwing a closure look on its community level physical capital and household level

physical capital. At first mining disturbed the community level physical capitals by acquiring the land under CBA Act and Land Acquisition Act. The 1957 CBA Act gives the permission to the government owned coal mining companies to acquire the land strictly for the purpose of mining. At the same time, the Land Acquisition Act of 1894, gives the permission for the infrastructural developments such as offices, residences etc. (MOC, 2014). Though it's a government initiated program, first it displaced the people either from their agricultural land or from their homestead land which predisposes the concern regarding shelter.

5.6.2.1. Community Level Physical Capital

The present study was undertaken in the mining affected villages where majority of them have been displaced from their respective agricultural lands. With agricultural lands they too lose their burial place, pasture land, grazing land, common field etc. Agriculture which serves as the heart of rural Odisha has exclusively disappeared from the scene. Very few households are practising agricultural practises. But it is not serving as the primary source of sustenance as all the remaining agricultural lands are filled with coal dust and waste particles. As it was already given in the Table No. 3.3, up to 31st March 2014, MCL has occupied 6491.868 hectares of tenancy land, 4448.314 hectares of govt. land and 2924.1 hectares of forest land. However, this is the overall land acquisition scenario of Ib valley and data regarding village wise and category wise land acquisition scenario is difficult to get. Still an attempt was made to provide a brief idea regarding this. The following table analyses the impact of mining on community level physical capital.

Table No. 5.3: Land Distribution (Village Wise)

Type of Land	Mining Affected Villages (Land in Acres)						Control Villages (Land in Acres)	
	Khairkuni	Ubuda	Darlipali	Kudopali	Kantatikira	Ainlapali	Grindola	Talapatia
Agricultural Land	700.40	655.48	310.67	314.34	134.54	79.74	998.55	1006.48
Grazing Land	48.51	40.83	17.99	55.35	13.15	6.82	23.32	48.05
Cremation Ground	2.15	2.10	NA	NA	NA	NA	1.70	8 Decimal
Play Ground	6.14	NA	NA	6	NA	NA	18.10	91 Decimal
Common Field	21.37	25.22	13.17	20.97	11.22	4.58	35.20	54.20
Village Forest	136.29	161.99	100.44	514.65	92.56	15.41	936.939	120.76
Others	281.31	381.85	235.03	164.41	103.39	107.27	946.951	2552.8
Total Land	1196.170	1267.470	677.300	1075.72	354.86	213.82	2960.760	3783.74

Source: Tahsil Offices of Jharsuguda & Lakhanpur

The above Table No. 5.3 describes the village wise distribution of land. Among them, Ubuda possessed possessed majority of land (1267.470 Acres) followed by Khairkuni (1196.170 Acres), Kudopali (1075.72 Acres), Darlipali (677.300 Acres) and Kantatikira (354.86 Acres) respectively. It is pertinent to mention here that the land records of mining affected villages are according to Major Settlement Year of 1980-81. Opencast mining was started in the year of 1984 and after that the subsequent mines are widening their wings. Though MCL is acquiring the lands but no such conversion of land is taking place. So the appropriate data on acquired lands are not available. But during the field study it was observed that except Ainlapali, where not a single patch of land was acquired by MCL, all other villages have lost their grazing land, cremation ground, playground, common field, village forest etc. In Kantatikira village, very few units of residents are having agricultural land. So also is the case of Ubuda village where some people are having small patch of agricultural land. On the other hand, land as a physical capital is available in abundant in both the control villages. Any technological inventions have not disturbed the land holding structure/pattern of these villagers.

Though mining intervention has changed the scenario still land is regarded as the most essential physical asset of rural Odisha. However no such exact data are available on the availability of land after the execution of mining but the percentage

of landless, large land holders, marginal land holders etc. was drawn from the sample villages (Table No. 3.4).

However, the magnitude of the land holders was already discussed in the Table No. 3.4. According to the estimation during the pre-mining phase majority of the households (38.4 percent) were possessing large amount of land. However, the intervention of mining has brought landlessness and as a result 63.3 percent residents are landless. Those who possess some land are mostly small and marginal farmer. In contrary to this, only 1.7 percent households are having more than 15 acres of land. But the scenario of control villages is absolutely different. Here, majority (39 percent) of the households possess more than 15 acres of land followed by 31 percent of minor landholders.

Infrastructure: The second major impact of mining on community level physical capitals is its influence on infrastructural development. Under the CSR activity of MCL, a provision of infrastructural development within fifteen kilometres of radius of mining operation is mentioned. Therefore, the construction of well-connected roads and haul roads was made. But due to improper maintenance these roads are termed as accident prone roads. The road towards Samaleswari OCP and its surrounding villages is highly polluted as well as regarded as more accident prone. While the roadways condition to the mining affected villages are absolutely neglected, the roadways condition towards its area offices, guest house, residential setup and rehabilitation sites are quite good. This can be visualised by taking the following case.

Meghanand Bhoi, 45 is a perment resident of Kudopali village. This village is barely 150 meters away from Samaleswari OCP. MCL has acquired all the agricultural land of this village and in return provided monetary compensation along with employment for one member of each family. As a result, Bhoi got a job in the Himgiri-Rampur Colliery. So it's a usual routine for him to attend the shifts and everyday he needs to go by the same accident prone road. So it's quite normal for him to meet accident. But surprisingly in the month of June he met with three accidents and due to this he was not able to maintain continuity in his job. For him, consequently, the month of June is normally a rainy month and the roadways condition is not at all good, that's why he suffered. (Case 5.3)

Many more accidental cases were also recorded from the villagers of Ubuda and Darlipali. Even the transportation facilities of these villages are not so good. The villagers of Ubuda are the worst sufferers as MCL has blocked all kinds of connectivity to this village. To avail the household necessities such as vegetables, food stuffs they are experiencing much difficulties to reach the nearby Bandhabal village which is 6 kilometres away from this village. Even the reason behind college dropouts of Kantatikira and Ainlapali village is the unavailability of suitable transportation. However, the economically deprived people are becoming college dropouts as they cannot afford a vehicle of their own to reach at the nearest college which is around 10-12 kilometres away from their respective villages. The reason of hesitation to attend college is not because of distance but unavailability of means of transportation. On the contrary, the transportation facility of control villagers is somewhat better. Grindola village is located in the boarder of Jharsuguda and Sundargarh district, so the buses and other public transported vehicles which are moving between these two districts are frequently available. Talpatia is a roadside village, so the transportation is quite easy and frequent.

All the mining and control villages are having electricity. But this connection was given by government not by MCL. Other infrastructural facilities like panchayat office, post office, anganwadi centre, primary school etc. are available in all the mining affected villages. These developments were possible because of governmental intervention. MCL has constructed community centres at Kudopali, and Ainlapali villages. One community centre was constructed at Kantatikira by World Bank. While conducting a research on the impact of mining on social capital, a team of World Bank felt the need of a community centre at Kantatikira village and it was materialised during the study itself. As Darlipali and Ubuda are already declared as coal bearing areas and the villagers are going to be displaced in a year or two, no such provision of community centre was made there.

Water Supply: All the mining affected villages are facing the problem of inadequate water supply mostly in summer seasons as the water level goes down. Reportedly, the villagers of Darlipali are the fortunate enough to avail MCL's water supply throughout the year. But the villagers of Kudopali, Kantatikira, Ainlapali and Ubuda are experiencing more difficulties as they are not having adequate drinking water during summer seasons. The water tankers of MCL are not providing drinking water

on a regular basis. The frequency of these tankers is hardly twice or thrice a week which is not at all sufficient to meet the need of households especially during the summer season. In this regard, the residents approached the MCL officials to get adequate water but the response of the officials was not positive. Rather the officials blame the contractor for this inconvenience. Water supply is not regular for Khairkuni village but most of the villagers are having bored-wells and during summer season other villagers used to collect drinking water from these houses. The control villages are also experiencing some difficulties during summer but the availability of panchayat level drinking water supply is meeting their need.

5.6.2.2. Household Level Physical Capital

Besides this, physical capital has sheer positive impact on household level. Compared to pre-mining phase, now all most all the villagers are having their own houses. This can be analysed from Table No. 3.5. As per the table (No. 3.5), after mining the economically well-off households are staying in the pucca and semi-pucca houses and the economically deprived communities are continuing their livelihood in the kutcha houses. This is because of the improved economic condition and increased purchasing power. However, majority of the households are earning good revenues as they have permanent employment in the mines. During the pre-mining phase majority (43.3 percent) of the households were having kutcha houses. Only financially resilient and empowered sections had pucca and semi-pucca houses. Even the underprivileged sections were having huts and temporary houses. As compared to this, in the post mining period only 4.3 percent are staying in the temporary houses as they are in the verge of displacement. However, majority of the control villagers (52 percent) are still staying in the kutcha houses. While a small bunch (8 percent) is having pucca houses, others are still staying in the huts and temporary houses. The change in the housing pattern is clearly visible in the mining affected villages. One single factor behind this is the permanent source of income from mining. Besides housing pattern significant modifications were marked in the possession of household level assets. This can be visualised from the Table No. 5.4.

Table No. 5.4: Household Level Physical Assets[17]

Assets Owned	Mining Affected Villages				Control Villages	
	Pre-Mining		Post-Mining			
	Yes	No	Yes	No	Yes	No
Cycle	285 (95)	15 (5)	300 (100)	-----	85 (85)	15 (15)
Motor Cycle	13 (4.3)	287 (95.7)	180 (60)	120 (40)	23 (23)	77(23)
Bullock Cart	178 (59.3)	122 (40.7)	2 (0.7)	298 (99.3)	56 (56)	44 (44)
Pump Set	62 (20.7)	238 (79.3)	15 (5)	285 (95)	14 (14)	86 (86)
Craft Cutter	296 (98.7)	4 (1.3)	41 (13.7)	259 (86.3)	64 (64)	36 (36)
Plough	179 (59.7)	121 (40.3)	16 (5.3)	284 (94.7)	59 (59)	41 (41)
Livestock	298 (99.3)	2 (0.7)	32 (10.7)	268 (89.3)	87 (87)	13 (13)
TV	49 (16.3)	251 (83.7)	273 (91)	27 (9)	45 (45)	55 (55)
Fridge	3 (1)	297 (99)	151 (50.3)	149 (49.7)	19 (19)	81 (81)
Radio	105 (35)	195 (62)	198 (66)	102 (34)	16 (16)	84 (84)
Tractor	4 (1.3)	296 (98.7)	23 (7.7)	277 (92.3)	6 (6)	94 (94)
Power Tiller	-----	-----	6 (2)	294 (98)	11 (11)	89 (89)
Dish Antenna	-----	300 (100)	204 (68)	96 (32)	13 (13)	87 (87)
Cooler	6 (2)	294 (98)	196 (65.3)	104 (34.7)	6 (6)	94 (94)
Mobile	-----	300 (100)	268 (89.3)	32 (10.7)	41 (41)	59 (59)
Others	116 (38.7)	184 (61.3)	283 (94.3)	17 (5.7)	33 (33)	67 (67)

Note: Figures in parenthesis are percentage.
Source: Field Study

The above Table No (5.4) states that majority of the sample households of post mining phase are having motor cycles, TV, fridge, radio, cooler, dish antenna, mobile phones, tractor and power tiller. These commodities were quite rare or absent during pre-mining period. In the post mining phase, the rise of income as well as purchasing power due to employment in the mining and other allied sectors encouraged the people to procure all these products. But there are some assets which were possessed by the residents much before the intrusion of mining.

As agriculture is not the primary source of sustenance, the residents are not so curious to possess the assets like bullock cart, pump set, craft cutter, plough etc. But the possession of tractor and power tiller is more in comparison to the pre mining phase. As mining has increased the financial condition of the residents, a few of them brought tractors to engage them in mining related activities. Even some of them are giving it on rent to the neighbouring villagers.

[17]Possession of assets (out of 300 Samples in mining affected villages and 100 samples in control villages)
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So the central cause of possessing these tractors and power tillers is nothing but monetary gain. The possession of livestock was quite high in the pre-mining stage. However, in post mining period, the unavailability of grazing land, polluted water and the rise of various diseases have discouraged the villagers to keep livestocks. On the other hand, the control villages are primarily agro-based. Owing to this, the villagers are possessing plough, bullock cart and craft cutter more in number. The modern means of assets like TV, fridge, dish antenna, motor cycles and mobile phones are not available adequately due to average earnings of the households.

5.6.3. Impact on Financial Capital

Financial capital is utmost imperative as it describes the economic stand-up of a household. It indicates the financial possessions which have a direct connotation on people's economic existence in a society. However, it not only embraces the stock and flow of financial resources but it also cuddles consumption and production units. Households used to employ diversified income sources to raise their financial capital. As it has already been discussed (Table No. 5.1) that people of both mining and non-mining regions are in practice of adopting diversified income earning sources. Though diversification of livelihood was quite prevalent in the pre-mining phase, it has lost its importance in the post-mining period.

Here in this section their yearly income from these sources will be analysed. As mining is a total replacement of agricultural practices, the per capita income of the mining affected villages is quite better compared to the control group households. It was already discussed in the chapter no. 3 that the percentage of BPL households were more in number during pre-mining phase but in the post mining phase it came down to 6 percent only. Though mining is providing a permanent and continuous source of income, most of the households are earning more than 2000 rupees in a month. Then again, the pre-mining period was mostly agro-based and agriculture was a seasonal activity. That is why most of the households were below the poverty line. In compare to the mining villages, more households in control villages are coming under the BPL list because of the lower per capita income.

In post mining phase the household income of the mining affected villages is quite better in comparison to the pre-mining and control group villages. As mentioned in Table No. 5.1, 51 percent of mining affected households are having permanent

employment either in underground or in opencast mines. This permanency ascertains a boost towards the increase of financial capital among the mining communities. The second major group i.e. unskilled non-farm wage labourers are earning a wage of 150 rupees in case of male and 120 rupees in case of females. Even the employment in government and private organisations and income from fixed premises are more in number.

Table No. 5.5: Average Annual Income of the Households
(From Primary & Secondary Sources)

Annual Income	Mean	Standard Deviation	Minimum	Maximum
Pre Mining Scenario				
Primary Sources	41,046.00	32,135.111	18,000	219,600
Secondary Sources	6,658.00	55,19.382	700	40,000
Post Mining Scenario (Working Communities of MCL)				
Primary Sources	184,313.73	97,163.486	144,000	480,000
Secondary Sources	15,929.34	11,155.606	9,500	43,000
Post Mining Scenario (Non-Working Communities of MCL)				
Primary Sources	66,281.63	19,760.352	36,000	120,240
Secondary Sources	6,745.24	687.071	4,350	8,000
Control Village				
Primary Sources	58,734.90	32,110.902	16,650	126,000
Secondary Sources	4,868.75	2,245.672	1,120	17,640

Source: Field Study

The above Table (No. 5.5) indicates the annual income of the households both from the primary and secondary resources. It is evident from the above table that, the working communities of MCL are earning good revenues. Though they have permanent employment in the mines, they are earning minimum 1 lakh 44 thousand rupees in a year. Even among the MCL workers diversity on income persists. This is because of the year and post of employment. Those who joined jobs recently are earning 12 thousand rupees and those who have already crossed 20 years or more are earning not less than 40 thousand rupees in a month.

However, the non-workers of MCL are earning an average income of 184,313.73 rupees per annum. The analysis on variation of income from mining sources in both pre mining villages and control villages show more or less similar kind of result. As both the society was agro-based and the occupation was seasonal, the variation was very less. In practising agriculture, the entire household gets involved in the process

of production. As a result they are maintaining all the features of mechanical solidarity. However, the situation of post mining period is quite different. In comparison to pre mining phase and the control villages, the growth was observed in the context of annual income. Again, the income variation was quite high among the working communities in comparison to non-working communities. While the working group of MCL are earning good revenue, the non-working communities are striving hard to cope with the situation (Table No. 5.5). Even the income variation among the residents of control villages and pre mining villages is higher than the non-working communities of post mining phase. It can be stated that both the working and non-working communities are only working for the benefit of MCL and not for them. In the process, mostly the working communities of MCL are getting alienated from the productive activity, from the product, from themselves and from their fellow workers.

The employees of MCL are mere actors who are only following the instructions of their authorities. As they have already lost their productive land, they need to earn for their livelihood. In the whole process they are only engaging themselves with the needed performance of MCL and are not doing any other activity except the prescribed guidelines. This situation forces them to alienate from the manufactured goods. In the next phase, the employees don't have any right on the product as they are only the workers who used to work there in lieu of wage. This shows the alienation from the product. Being alienated from the entities of their employment and the practice of production, they are getting alienated from their own productive activities. And in the last phase, the employees are working in separate sections as per their own specialization. For example, a driller works to drill the bore holes; a loader loads the mining carts etc. This type of specialised work alienates the workers from their fellow workers.

From the above analysis it is clear that even after earning good revenues, the working communities are developing varieties of alienation among them. Another characteristic of income is the class difference. In the post mining era, the employees are earning healthy amount of revenues and the non-employees are working hard to fit with the current market price. So a visible class difference has arrived in the mining affected villages. The financially well-off people keep on adding varieties of household assets and they hardly bother regarding the vulnerable condition of others.

Primary sources are not the only means of income for the rural households of Ib valley. Diversified sources are also associated with them. Although the sources have been replaced in the mining affected villages, still they are in practice among the rural communities. However, the working communities of MCL are earning more from the secondary resources too. Though they are more exposed to the outside world, they are earning good profits from the secondary occupation such as *beedi* making, house rents etc. Yet again, the control group households are still drawing their income from common property resources. Only 3 percent households are earning their livelihood from fishing and other allied activities. Fishing activity is being predominantly practised by the villagers of Talpatia as this village is located on bank of the river Ib and villagers of Grindola are more inclined towards assortment of minor forest products such as firewood, bamboo, *chara*, cereals, *kendu* leafs etc.

5.6.3.1. Annual Expenditure

Impact on financial capital cannot be assessed without expenditure. Though mining has provided ample of scope for the rise of annual income, at the same time it also provided the atmosphere for expenditure.

Table No. 5.6: Annual Household Expenditure

Average Household Expenditure (Pre Mining)					
Items	**N**	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
Food	4500	8200	24000	13109.67	3749.971
Education	176	500	1800	694.83	179.994
Clothing	213	500	1580	959.62	338.621
Entertainment	148	80	700	241.69	183.691
Infrastructure	188	100	650	300.53	189.197
Fuel	107	200	3600	786.07	687.861
Health	300	750	2200	1376.64	320.301
Total Household Expenditure	300	22000	52000	41660.00	6198.856
Average Household Expenditure (Post Mining)					
Items	**N**	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
Food	300	12000	36000	28735.67	6455.758
Education	253	780	100000	11835.38	19962.947
Clothing	260	850	19000	3137.81	4517.776
Entertainment	235	750	6000	2419.79	1418.664
Infrastructure	300	1000	5000	2781.33	1764.491
Fuel	233	1200	5400	2840.34	2053.448
Health	300	4000	8000	4552.32	719.066
Total Household Expenditure	300	30000	120000	76133.33	32633.296

Average Household Expenditure (Control Villages)					
Items	**N**	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
Food	100	5000	32000	14730.	6139.959
Education	64	500	25000	1751.56	4355.839
Clothing	46	7000	20000	1604.35	3204.421
Entertainment	39	200	1000	382.56	219.709
Infrastructure	35	100	10000	1581.43	2565.211
Fuel	23	400	4800	963.91	1057.453
Health	100	150	12500	1399.00	2783.800
Total Household Expenditure	100	9000	63520	29006.20	11432.691

Source: Field Study

It was observed that, prior to mining, the average annual household expenditure was comparatively low than the post mining phase. Even it has a positive resemblance with the control villages (Table No. 5.6). The categorical household expenditure shows that in the post mining phase, starting from food to health, at every section the expenditure is more. Of the, average expenditure on health has striking significance with mining. The mining affected households are spending more money on health, as they are falling ill frequently. In the context of fuel, the expenditure is also more. Prior to mining, the rural people were entirely dependent on wood and cow-dung centred fuel woods. But mining has diminished the forest based products and pollution has restricted the households to keep livestocks like cows. So, the mining affected communities are entirely dependent on coal and gas connection (Table No. 5.7). Besides these two categories, variation was also marked in all other categories. But in the control villages, very minor difference was marked in comparison to pre mining situation. But this is not because of any developmental activities; rather the growing market price is the central cause behind this.

5.6.4. Impact on Natural Capital

In the sustainable livelihoods framework natural capital implies the accumulation of natural assets such as land, forests, water, air quality, wild resources, minerals, biodiversity and so on. In the SL framework natural capital has closure proximity with the vulnerability context (DFID, 2000). In the present study, mining as a vulnerable act has a direct negative impact on natural capital. In the rural setting natural resources such as fishing, farming, collection of forest based resources etc. significantly contribute towards the sustainability of livelihood. Habitually, the rural

people are so used to with the natural resources that their way of life became ridiculous after the establishment of mining industry.

5.6.4.1. Impact on Natural Environment

At the outset of mining, first ever impact on natural environment is pollution of air and water. The air quality is degrading day by day and the temperature is raising so high that in summer it is difficult to breathe. The emission of coal dust at the time of operation and transportation is making the life miserable. Though it is mentioned in the CSR activity that the coal loaded vehicles should be well covered by tarpaulins at the time of transportation, no such attention has been given in this regard. The villages nearer to mining i.e. Darlipali, Ubuda and Kudopali are the worst sufferers. This can be analysed by taking the following case.

> Samari Gop is a resident of Darlipali village. She is a wage labourer in the nearby Belpahar OCP. Due to work she is inhaling coal dust daily. And after returning home she is facing same problem as her village is surrounded by Belpahar OCP, Lakhanpur OCP and Lilari OCP. The dust coming out of the nearby three OCPs is compelling her to wash her utensils many times a day. Even she cannot wear a white cloth as it is getting dirty quickly. According to Samari, every day they are consuming at least 200 grams of coal through food, inhalation and water. (Case 5.4)

This is the view of every household living near the mining affected regions. Next to air the second important natural resource is water. The natural water bodies like streams and rivers have vanished from the scene and the artificial water bodies such as pond, tube-wells and open-wells are drying up frequently. Only Darlipali has a natural stream i.e. Lilari Nallah, which is filled with coal dusts. This is the only source of water for bathing and drinking for the villagers and every day the release of waste water from the surrounding three mines is not only polluting the water quality but is responsible for varieties of water borne diseases. However, Kudopali is having a pond and the villagers of Kantatikira and Ainlapali are coming to this village to carry out bathing and washing. The villagers of Khairkuni is travelling to the nearby *Bandha* (Pond) which is two kilometre away from their village. At the same time, economically well-off communities are performing their daily activities like bathing and washing in their own houses as they have their own bore wells. Most often, the villagers complained that the drinking water provided by MCL is not like normal water and even they discover a layer of lubricious component floating above the

water. In contrast, the natural environment of control village is quite better than the mining affected villages. They are the proprietors of fresh air, clean water and rich natural resources.

5.6.4.2. Impact on Natural Vegetation

Demolition of natural vegetation is severe as mining has acquired the forest lands also. The households who had their primary income from the natural resources like fishing, haunting, and collection MFPs have lost their livelihood. Even the loss of grazing land is compelling them not to possess any livestock. Though the commoners are earning quite good revenues at present than pre-mining period, still they are not able to do any saving as expenditure on health, hygiene and food is more than that of the previous period (Table No. 5.6). Even they lost their major (i.e. wood and cow dung cake) means of cooking.

Table No. 5.7: Primary Cooking Fuels

Primary Cooking Fuels	Mining Affected Villages		Control Villages
	Pre-Mining	Post-Mining	
Wood	54 (18)	-----	70 (70)
Charcoal	-----	-----	-----
Kerosene	7 (2.3)	-----	3 (3)
Cow-dung Cake	14 (4.7)	-----	-----
Gas	-----	17 (5.7)	8 (8)
Coal	-----	203 (67.6)	-----
Wood & Cow-dung	223 (74.3)	-----	12 (12)
Charcoal & Cow-dung	1 (0.3)	-----	-----
Gas & Coal	-----	80 (26.7)	-----
Wood & Gas	-----	-----	7(7)
Total	300 (100)	300 (100)	100 (100)

Source: Field Work
Note: Figures in the parenthesis are percentage

The above table clarifies that majority of the households in post-mining phase are using coal as their primary source of cooking fuel. For this purpose they are stealing coal from the nearby mines and after fulfilling their own need they are selling it secretly to other households. For one packet of coal, they are earning 25 rupees. Only the financially well-off households are having gas and the middle class households are preparing their food stuff through gas and coal. Though the availability of abundant amount of coal is solving their cooking problem, still the emission of coal smoke

during cooking is causing health problems. So the daily release of coal smoke and fog is also contributing towards air pollution. During the pre-mining phase they used the following fuel for cooking such as fuel wood, cow-dung, kerosene and charcoal. On the other hand, in the control villages, except some rich households (8 percent) majority of households (70 percent) are still preparing food by fuelling wood, cow-dung and kerosene. The major factor behind this is the availability of abundant natural resources in and around their village.

5.6.5. Impact on Social Capital

In the sustainable livelihood framework social capital bears a distinct identity as it involves "networks together with shared norms, values and understandings that facilitate co-operation within or among groups" (OECD, 2001). It deals primarily with networks and connectedness among a cluster of individuals who are connected with each other with some sort of trusted relationship, reciprocity and exchange (DFID, 2000). In the present research mining has interrupted the network connectivity among the mining affected villagers. Because of mining massive acres of land have been dugged and thousands of households have been displaced from their homestead as well as agricultural lands. Some have voluntarily left the place and substantial amount of households have been forcefully displaced. Under this circumstance, the displaced communities attempt to renovate their social network in a completely new domain which reinforces them as aliens.

In this process the displaced sections have been entirely disconnected from their other kin members. Again, displacement is not only creating fragmentation but it also sparks family disputes. According to the Resettlement and Rehabilitation Policy of MCL, it provides monetary compensation to the project affected family and offers permanent employment to the elder son of a family. In this aspect other members of family revolt against this deal and sometimes they are indulging themselves in varieties of immoral activities. Table No. 5.8 describes the total employment that has been provided to its land oustees by MCL since its inception. According to the official data of MCL, it provided permanent employment to 3088 deserving Project Affected Persons (PAPs). Though the number of PAPs are quite high, all are not fortunate enough to avail the opportunity without any difficulty. This can be analysed by taking the following case.

Nuadei Seth is a resident of Kantatikira village. She is a widow and has five children. In the year of 1989 she lost 5 acres of agricultural land during the establishment of Samaleswari opencast mine. Up to now 23 years have already been passed and for employment she is running from offices to offices but no one is paying any attention towards her problem. As agriculture is the main source of income and she has already lost her agro-land, now she is working as a wage labourer to sustain her livelihood. Due to monetary issues none of her children attended school. Her elder son is working in the nearby Bhatia Coal Washeries and others are also working as daily wage labourers at the adjacent crusher industry. (Case5.5)

Table No. 5.8

Employment to land oustees provided by MCL since inception

(Figure of IB Valley Coalfield)

Name of Area	Job offered before 1992(before implementation of 1989 policy)	Job offered from 1992 to Feb. 2014				Sub Total	March 2014				Sub Total	Job offered from 1992 to March 2014				Sub Total	Grand Total (including job offered before 1992)
		A/(i)	B/(ii)	C	D		A/(i)	B/(ii)	C	D		A/(i)	B/(ii)	C	D		
IB Valley	612	79	163	96	43	381	0	0	0	0	0	79	163	96	43	381	993
Lakhanpur	1007	322	50	118	0	490	3	0	2	0	5	325	50	120	0	495	1502
Basundhara-Garjanbahal Area	0	445	31	40	57	573	0	0	0	0	0	445	31	40	57	573	573
Orient	10	1	2	7	0	10	0	0	0	0	0	1	2	7	0	10	20
IB Valley Coalfield	1629	847	246	261	100	1454	3	0	2	0	5	850	246	263	100	1459	3088

Source: MCL Office

5.6.5.1. Resettlement Status

The Table No. 5.9 describes the resettlement ratio of the project affected households. As of 31st March 2014, according to official records of MCL 1152 project affected households have been resettled. Of them, 600 have been resettled at the resettlement sites and 552 have been resettled at the site of their own choice. However, a balance of 1150 households needs to be resettled. This is the official record only. The original scenario is quite different as every mining affected village is facing the same difficulty. Yet it is clear that MCL is providing employment to the landholders but there is no such provision for landless. Prior to mining the landless used to work in the lands of landholders and after mining the landholders are obtaining compensation for their loss of land. So the previous social relation between the landholder and landless have been destroyed completely.

Table No. 5.9: Resettlement Status of IB Valley Coalfield (As on 31.03.2014)

Name of the Project	No. of PAFs Required to be Resettled	Total No. of PAFs Resettled	No. of PAFs resettled		Balance	Existing Resettlement
			Resettlement Site	Site of their Own Choice		
Basundhara (E) OC	132	132	132	0	0	Tikilipara
Basundhara (W) OC	217	217	124	93	0	-------
Lakhanpur OCP	1131	465	140	325	666	Ganesh Nagar & Jagannathy Nagar
Belpahar OCP	509	141	84	57	368	Khadam & Belpahar
Lilari OCP	39	39	39	0	0	Belpahar
Samaleswari OCP	184	77	0	77	107	Sanjob
Lajkura OCP	90	81	81	0	9	Takua
Total	2302	1152	600	552	1150	NA

Source: MCL Office

In search of employment opportunity, clusters of migrants are coming to the mining regions and during their stay the amalgamation of cultural identity is taking place which in turn disturbs the actual ethnic identity of the region. Despite this, some social evils such as drug addiction, corruption, alcoholism have also emerged.

From the positive point of view it has been observed that in most of the cases all the mining victims are working jointly to achieve their own right. The villagers of Kudopali are approaching repeatedly to the authorities of MCL about their displacement. According to them the place which have been provided for their resettlement is not at all productive, located near a mountain and is far away from their actual place of work. In this village most of the households are having job either in the Bundia underground mines or in the nearby Samaleswari mines and if they will resettle in any distance place it will again create trouble to join their job. Moreover, the same villagers have another issue related to their network connectivity. While expressing their grievance, around 30 households in Kudopali village replied that, it took long time to establish the social relation with the existing villagers after they got displaced due to the construction of Hirakud Dam. After years, again they are going to be displaced due to a separate development project i.e. mining. In this situation they are afraid of their social security as well as network ties. A slight different case was observed at Khairkuni village.

> Budhu Bhoi aging 69 is a resident of Khairkuni village. He explained that previously they were living in the old Khairkuni village which is now a mining hub of Lakhanpur OCP. Because of LOCP they have been displaced from their village and now 150 households including his family are living in this new Khairkuni village which is 3 kilometres away from LOCP. Some days before while digging a well inside his house the diggers discovered ample of coal deposit in the same area. So now Budhu is afraid that if the MCL authorities will come to know about this, then they will surely displace him from this area. (Case 5.6)

These two issues are glaring examples while the matter of double displacement is very popular in this belt. Because of economic development of their nation the innocent population are paying their social cost. On the other hand, the issue of social capital is absolutely absent in case of control villages. They are not passing through any fear of displacement or double displacement. However, the permanency with their traditional land and society has preserved their social capital without any disturbance from the outside world.

5.7. Impact of Mining on Woman's Livelihood

Women communities are regarded as the most vulnerable segments of society. They do not enjoy the same status which their male counterparts usually possess. In the

present research prior to mining the position of women was only restricted to household related activity. The most important activity they need to fulfil is to feed their family members and to look after their off springs. Still they used to spare some valuable time for the collection of Minor Forest Products such as firewood, timber, *chara*, *kendu* leaves, cereals, fibres etc. And after fulfilling the need of their own house they used to sell some products like *chara*, firewood, cereals etc. in the nearby weekly market. This was the only source of income for the women folks. But mining has disturbed this activity entirely.

As we have already discussed that rural livelihood of Ib valley was primarily agro-based which necessitates both man and woman to work together. Women communities of scheduled caste and scheduled tribe groups were mostly engage in seasonal agricultural activities. But mining has ruined this activity and owing to this woman folks are now working in the non-farm sectors. After a day-long hard work when male workers are getting 150 rupees, female workers are receiving 120 rupees only. This point indicates the age-old disparity with which women folks are struggling. Predomination of patriarchy have been transferred genetically.

A major chunk of women folks of Ubuda, Darlipali, Kantatikira and Kudopali villages are preparing *beedi* and earning some rupees out of this practice. By making *beedi* they are earning 500-600 rupees a month. This is not at all practised by the women community of lower caste groups. This is in practice among the females of upper castes too.

While the women folks of mining communities are struggling to secure a livelihood of their own, the female groups of control villages are still sheltered. They are drawing their traditional pattern of livelihood by collecting MFPs. The most practised activities among them are the preparation of leaf plates from *sal* leafs and making of bamboo baskets. Besides this they are planting verities of seasonal flowers and vegetables which they used to sell in the adjacent village market. Moreover, in comparison to the mining affected villages, livelihood of control villages is quite natural and a touch of permanency exists among them.

5.8. Policies, Institutions and Mining

The establishment and authorisation period of mining projects leads to more social conflict as it involves heaps of strong opponents as well as a handful of vigorous supporters (Davis and Franks, 2011). Execution of mining industry is not a rosy path to obtain as it brings significant modifications (Carolina, 2013) in the household, community, village, state and the national level. Along with impairment of some domains, it also brings significant modifications by improving the assets of rural poor (Ellis, 1999).

According to the villagers of mining affected villages, at the beginning of mining they all oppose it. They did hunger strike, went to jail and even conducted several road blockages. But finally they surrendered in front of MCL and government of Odisha. Though they have already accepted the fact that mining is not going to stop rather it will continue to upsurge its wings. Now they are demanding most valuable stuffs such as back filling of mined out regions, refilling of abandoned mine sites and prepare them for some productive purpose, adequate and regular water supply to all the mining affected villages, reparation of roadways, minimization of air, water and noise pollution, employment opportunity for the landless and appropriate and immediate distribution of compensation package. Except this the forest department should propose some realistic act regarding compensatory afforestation. According to the Land and Revenue manager of Ib valley area whenever they are cutting any forest, they are doing thrice compensation by planting cost-effective trees in Sambalpur district. Here comes the argument that what is the benefit of Ib valley when the particular region is becoming barren land and a neighbouring district is fetching the benefit. Whenever the MCL authorities are doing any small scale plantation usually they are planting some nursery trees which are dying within a short interval of its plantation. So the local residents are demanding for their indigenous trees and plants.

These issues need to be addressed jointly by MCL authorities, forest department, pollution control board and department of water resources. If these disputes will be sorted out mutually then a people friendly and agitation free region can emerge.

5.9. Livelihood Outcomes

Sustainable Livelihood Framework of DFID presupposes a positive livelihood outcome. But in the present research mining has both positive and negative impact on the livelihoods of rural households. Though it raised the financial capital, standard of living, possession of household level physical capitals and improved some sort of human capitals, at the same time it diminished the natural resources, disturbed the community level physical capitals, modified the network ties etc. In one sphere it provided all kinds of physical and infrastructural improvements but on the other hand it alienated the people from their traditional agro-based livelihoods. When it took a way forward to provide employment it developed dispute among other family members as it provides employment to a single member of a project affected household. In this context, Karl Marx's theory of alienation finds a secure place to stay.

The central argument which revolves around this chapter is "Is mining providing a sustainable livelihood?" No doubt majority of households are earning good revenues by indulging themselves in mining related activity but what their offspring will do? Because it has already proved that mining is a short-lived industry and after excavation of abundant minerals the authorities are closing down the sites. For example, in course of time mining activity is decreasing at Lilari Opencast Mine. As per the sources MCL is going to close this opencast project in a year or two. Like this all other mines are also going to stop excavation one day. In that situation what will be the means to sustain a secure livelihood is a matter of concern now. To protect the livelihood of innumerable population, MCL should develop some strategy towards the benefit of project affected people who have been already handed over their central source of livelihood i.e. land for the purpose of national development.

Sustainable development necessitates varieties of aspects. In the present chapter the discussion was centred on the DFID proposed livelihood framework which basically focused on the impact of mining on five capitals of livelihood. As the rural Odisha is confined basically with agro-based livelihood, the present research tried to bring the agricultural scenario of Ib valley. The next chapter will focus on this aspect.

Chapter-VI
Mining and Agriculture

6.1. Introduction

The economy of India produces its off spring by proliferating basically on agricultural mode of production. Though the Indian society concedes on varieties of revenues for livelihood generation, still it places its prime substance on agriculture and cultivation. Agriculture is regarded as the backbone of Indian economy. Around two third of rural inhabitants earn their livelihood from agriculture (Srinivasarao et. al., 2011). According to the Agricultural Census of India (2010-11), it affords profitable employment and livelihood for majority of the population and subsidizes significantly to the national income (ACI, 2011). But on the due course of time, this sector of economy has undergone a change in the era of development. More precisely the large scale development activities such as establishment of multipurpose projects, reservoir, thermal power plants and mining are taking place in the natural and rural environment, which thereby disturbs the age-old livelihood practice of native residents.Undeniably, industrial development is necessary for the economic growth of a country but it should not interrupt the principal component of wealth.

Though the rural communities of India are affected by varieties of development projects, the residents of Ib valley coalfield are highly affected by coal mining activities. According to the people residing there, agriculture was practised till the introduction of mining projects. But the establishment as well as expansion of opencast mining projects restricted them to continue the same. Hence, the mining affected crowd is barely depending on any kind of agricultural productivity. With this background the present chapter is an attempt to find out the impact of mining on agricultural production at Ib valley coalfield. Therefore, the aspects this section of the thesis will try to fulfil are as follows:

- To analyse the entire input and output of agricultural productivity
- To find out the accurate reason behind the loss of productivity if any in the study areas.

6.2. Impact of Mining on Agriculture: An Overview

Agriculture is the prime source of livelihood for the rural Indians. Due to the territorial setup and their closure proximity with nature, they practice agriculture since time immemorial. But the development diligences like oil and mining industries are often linked with degradation and diminution of crop yields which acts as a positive mechanism for the reduction of agricultural production (Aragon and Rud, 2012). However, the natural resources are fortunate enough to facilitate the manufacturing industries (Ploeg, 2011). The Southwest Mali and East Akim of Ghana conclude that, the farmers took great efforts to survive in a liberalized market economy. Here Artisanal and Small Scale Mining (ASM) helped the farmers by providing valuable anxieties like fertilizers. It also improved the financial condition of mining communities which could not be comprehended through farming (Hilson and Garforth, 2012).

Sometimes, the planned mining projects are proving to be destructive by harnessing natural vegetation and livestock. Because of this, the neighbouring residents are bearing the cost of vegetation loss and embracing varieties of health hazards (Lewis, 2010). During the initial period, the impact of mining destroyed the agricultural productivity. But gradually it obstructed the foodstuff to gratify the intricacy of the non-farm section (Binns, 1982). In most of the time the ambiguous connection between farming community and mining is generous to consign a constructive impact on agricultural production. Because of mining the farming communities can generate the market oriented food products and in turn it can bring positive outcomes to exhilarate the economic attributes of the community (Maconachie and Beans, 2007). The agricultural intensification, livelihood diversification and migration are the products of obscure affair between farming community and mining (Scoons, 1998). Mining can be rendered as a means for the exhilaration of financial capital by creating the circumstance for rendering good revenues (Tschakert, 2009).

Logically, surface mining has serious repercussions on farming. Since its execution, it has reduced the local agricultural productivity and also deteriorated the possibility of re-cultivation (Fry, 2011). In addition to this, the sheer decline of export crops and also the exclusion of subsidies are the important inputs to alter the farmers into non-farm activities (Hilson & Banchirigah, 2009). At times, even after applying more

inputs, the productivity is declining and the central cause behind this is the expansion of mining activities (Mishra & Reddy, 2012). However, due to the establishment of mining industries the rich sections of society are getting affected more than the poorer segments. By acquiring agricultural lands, it creates income inequality among the rich land-owning farmers and the landless poor. The deterioration of income occurs mostly among the rich than that of poor (Fatah, 2008).

Because of improper execution and planning, sometimes mining is threatening the food security of a country. In this context Doerr (1962) argued that in Oklahoma, coal mining is deteriorating the agricultural production as it has already occupied 12,000 acres of agricultural land. And every year they are stripping more than 18,000 acres of agricultural land. Except all these negative impacts, mining can also be proved as an essential attribute for the growth of agricultural production, on the basis of its nature and structure (Bury, 2004).

6.3. Impact of Mining on Agriculture at Ib Valley

As it is already discussed, agriculture is the central source of sustenance for the rural people of Odisha. However, the recent agricultural census articulates that the agricultural production is declining due to varied of factors. But in case of Ib valley coalfield the primary cause behind the non-practise and weakening of agriculture is the emergence of coal mining industries. Here, MCL is spreading its wings and the need for land is abating the local people from any kind of agricultural practices. Still a very trivial section of rural population is practising agriculture as their secondary source of livelihoods. As the study also included the control villages, it pronounces that, the control group residents were habituated with agro-based livelihoods and they hardly depended upon any external source to fulfil their regular prerequisites. In this context, it is necessary to inculcate the impact of coal mining on various attributes such as cropping pattern, production system, means of production, cost of production, sources of irrigation etc. All these aspects will be analysed in detail to draw the reasons behind the loss of production in the mining affected villages. To supplement this argument the present scenario of the control villages will also be analysed.

6.3.1. Cropping Pattern of Ib Valley

The residents of this district are practising both Rabi and Kharif crops. But Ib valley coalfield of Jharsuguda district is mostly a rain fed region. Owing to this reason, most of the occupants of this district are practising only Kharif crops. According to the Agricultural census of 2011-12, Ganjam district occupied the highest position (400 hectare) and Jharsuguda district occupied the last rank (62.61 hectares) in terms of Kharif cropped area. In case of Rabi crops the situation is also identical. During the practice of Rabi crops Ganjam district engaged 217 hectares of land and Jharsuguda district employed only 19.26 hectares of land (OAS, 2011-12).

The climate of Odisha is mainly tropical, it is characterised by high temperature, high humidity, medium to high rainfall and at last short and mild winter. Though there is a variation regarding district wise rainfall, in the year of 2011, the Meteorological department of India expected an annual rainfall of 1362.8 mm for Jharsuguda district. But as per the data of SRC, Bhubaneswar, the actual rainfall of this district was 1360.0 mm, which has a sheer negative impact on the cropping pattern. Conversely, during June to August the actual rainfall of this district was less than the expected rainfall.

However, all the sample villages of Ib valley coalfield were reportedly practising only Kharif season crops which starts with the arrival of monsoon and finishes in the mid of winter season. In course of field survey the cropping calendar of Ib valley was prepared. The following figure describes a detail note on Kharif season cropping pattern.

Cropping Calendar of Ib Valley (for Kharif)

June: Tillage of land
June/July: Planting of crop seeds
November/December: Harvest

6.3.2. Agricultural Scenario in Ib Valley

Depending on the climatic condition, the sample households of Ib valley are practising only Kharif season crops. Some of the respondents revealed that they were practising sugarcane but now they are not carrying out any such activity.

Paradoxically, it was noticed that out of six mining affected villages, the residents of only three villages were practising agriculture. But none of them appeared enthusiastic regarding agriculture. However, MCL has already taken away most of the agricultural lands and in return some of the PAFs have already received their compensation. Except Ainlapali village, five other villages have lost their agricultural land either partly or fully. Though the said village is only 3 kilometres away from Samaleswari OCP, still not a single patch of land was acquired by MCL. No doubt the land holding households are practising agriculture but due to mining dust they fail to cultivate the entire land. Ainlapali is a road side village and the some of the cultivable lands are also located near the roads. Consequently the regular movement of coal loaded trucks are the continuous factors for the release of coal dusts which in turn making it impossible to nurture any farming activity.

Even some the villagers of Kantatikira and Ainlapali responded that they have some land near the bank of the river Ib. But the untimely flood causing by MCL is destroying their crops. It is worth to mention that, every day the release of waste water by MCL is going directly to the nearby Ib river. And, most of the time, the over-release of waste water is scattering to the neighbouring agricultural fields which are destroying the crops inimically. Besides this man-made disaster, some natural calamities such as flood and heavy rain are also the reasons behind the loss of agriculture. Moreover, the natural calamities are very rare in this belt but the man-made calamities are the serious matter of concern. The other village which is in practice of agriculture is Ubuda. The villagers have already handed over their agricultural land to MCL but in some of the lands mining has not yet started. Owing to this reason, the villagers are still nurturing agricultural activity in the already acquired land. However, in the post mining phase the total percentage of households who are still involved in farming activity is only 10.6 percent (Table 6.3). But during pre-mining phase, vast majority of households (65.3 percent) were in practice of agriculture. Throughout the pre-mining period, the rural population were deeply attached with their agricultural lands and they used to earn their primary source of livelihood from agriculture itself.

The intrusion of mining activities forced them to shift their attention towards mining based activities and the rural people of mining affected Ib valley region are now entirely reliant on mining centred accomplishments.

Table No. 6.1: Key Features of Agro-based Households

Items	Mining Affected Village		Control Village
	Pre	Post	
% of Households Involved in Agriculture	196 (65.3)	32 (10.6)	70 (70.0)
Nature of Cropping Pattern	Pre	Post	Control Village
Seasonal	93 (31)	32 (32)	70 (70.0)
Continuous	103 (34.3)	-----	------
Total	196 (65.3)	32 (10.6)	70 (70.0)
Source of Water	Pre	Post	Control Village
Rain Water	80 (26.7)	20 (6.6)	46 (46)
River water	24 (8)	12 (4)	20 (20)
Canal water	3 (1)	----	----
Rain & River water	86 (28.6)	----	4 (4)
Rain & Canal water	3 (1)	----	----
Total	196 (65.3)	32 (10.6)	70 (70.0)
% of Households	Pre	Post	Control Village
Households with own cultivated land	183 (61)	15 (5)	46 (46)
Households with leased land	13 (4.3)	-----	24 (24)
Cultivating in the MCL acquired land	-----	17 (5.6)	-----
Total	196 (65.3)	32 (10.6)	70 (70)
Kharif Season Crop	Pre	Post	Control Village
Rice	191 (63.6)	32 (10.6)	70 (70)
Sugarcane	5 (1.7)	-----	----
Total	196 (65.3)	32 (10.6)	70 (70)

% of Cultivated Land	Pre		Post		Control Village	
	Yes	No	Yes	No	Yes	No
Cultivated the entire land	189 (63)	7 (2.3)	14 (4.7)	16 (5.3)	61 (61)	9 (9)
Total	196 (65.3)		32 (10.6)		70 (70)	

Source: Field Study

Note 1: Figures in the parenthesis are percentage

Note 2:The percentage was calculated from total sample size of both mining and control villages i.e. % for mining affected villages was calculated from the sample of 300 & % for control villages was calculated from the sample of 100.

With the increase of coal production MCL is acquiring more and more land and the rural people are leaving behind their farmlands. So the representation of agricultural practices has slowed down during post mining era. In contrast, majority of the control group residents (70 percent) were having agriculture practices. At the same time, they are far away from any kind of industrial interruption and till yet they are dependent on agro-based occupation. A remarkable variation was also found in terms of cultivated land. In the mining affected villages, out of 32 households 5 percent households are cultivating their own land and 5.6 percent households revealed that they are nurturing agriculture in the MCL acquired land. The villagers of Ubuda are mostly engage in this type of activity. This can be analysed by taking the following case study.

Tikaram Saha ageing 43 is a resident of Ubuda village. He is surviving with his wife, three children and widowed mother. While conducting interview schedule he reacted that MCL has acquired their 15 acres of agricultural land and in return provided one employment and some monetary compensation. As per the R & R policy of MCL, his elder brother has availed the occupational opportunity and also grabbed the entire compensatory money. Soon after the attainment of compensation, he shifted to the Ganesh Nagar resettlement site. Though MCL is planning to acquire Ubuda village under CBA Act, Tikaram is hopeful to achieve some compensation in place of his homestead land. As per now, he is still cultivating paddy in the already acquired land of his family. Although the Saha spouse are working as daily labourers in the nearby Lakhanpur OCP, still they find it difficult to run a family of six members by earning 220 rupees a day. So they are cultivating paddy in eight acres of land, mainly during the Kharif season. (Case 6.1)

Unlike the above mentioned case, some other households are also cultivating paddy in the already acquired land of MCL. In total 5.6 percent residents of Ubuda village are engage in this type of activity. For cultivation, water is an important aspect. Without water agriculture cannot be fortified. In the mining affected villages, the majority (6.6 percent) of the residents are still relying on rain water for cultivation. Some of the households of Kantatikira and Ainlapali are dependent on river water as their agricultural lands are very close to Ib river. Prior to mining the same residents were following several sources of water i.e. rain, river and canal water. Despite of multiplicity sources, majority (28.6 percent) households were dependent on both river and rain water for cultivation.

The cropping pattern of both mining affected and control villages are seasonal. This is due to the tropical uncertainty of this belt. But this was not the case during pre-mining

era. During that period, majority (34.3 percent) of the native respondents were practising it at a continuous process. Even they were practising the cultivation of sugarcane and other seasonal vegetables. But, the aftermath of mining is not only hindering them from the production of rice but it also deviating them to cultivate the entire land they possess. When the cropping pattern is decaying, it is almost impossible to imagine diversified crop which is regarded as one of the most important criteria for economic growth (Bharati, De and Pal, 2015). However, degradation of cultivable land, pollution, release of smoke and dust, high labour price and the uncertainty of rain are the causes behind the non-practice of cultivation. In contrary, majority (61 percent) households of control villages are cultivating the entire cultivable land they possess. At the same time, a small chunk of households (9 percent) gave an insignificant opinion regarding cultivation. As per their opinion, they hold some infertile as well as some flood affected land where agriculture cannot be practised.

6.3.3. Cropping Intensity

In the mining affected villages, out of 300 sample households, only 32 (10.6 percent) households are active adherents in the context of agricultural production. Despite of above mentioned odds they are practising agriculture as their secondary means and support of sustenance. While interacting with the native residents it was discovered that 16 out of 32 households are following a fallow period of 1 year after every Kharif season yield. In order to justify this approach, the rotation value (R) of Ruthenberg was calculated. According to Ruthenberg (1971a), the major factors that influence the growth of crop are climate and soil fertility.

Climatic condition is the main distinguishing factor for agriculture. Mostly the quantity of water supply and the temperature of a region determine the sustainability of agriculture. While the temperature depends on the pattern of rainfall, it has direct connection with the growth of crops. But in many parts of the world, the local residents are taking the advantage of solar energy to grow their crops and they are getting amazing amount of yields out of that. For example, Bradfield () described that the production of rice in Madras, India is 13400 kg per hectare in one harvest and production of sweet potatoes in the Philippines is 30 tons in 90 days, are the outcomes of proper water supply and suitable quality of soil. But depending on the seasonal

pattern of rainfall the situation varies from region to region. Apart from the climatic condition, soil fertility is another important factor for agriculture. The productiveness of soil provides the physical condition as well as delivers the inanimate nutrients and moistures for the plants to grow. On the other hand, the deficiency of these factors limits the growth of crops. But in most of the situation, the local residents used to practise their indigenous methods for controlling the soil, which includes inadequate disruption of the soil, use of organic waste and fallowing (Ruthenberg, 1971b).

In the present study, the native residues are intended to follow a fallow period to maintain the fertility of soil. As per their approach, mining has already degraded the quality of land and if they will do cultivation every year, it will degrade the natural aptitude of topsoil to reinforce its productiveness. This assumption can be justified by analysing the relationship between crop cultivation and fallowing. Hence, the formula of R factor is as follows:

$$R = \frac{C \times 100}{C + F}$$

The numeral 'R' is the number of years of farming multiplied by 100 and divided by the interval of a series of land use. Then, the interval of a series is the amount of the years of cultivation plus the years of fallow period. According to Ruthenberg, if the R value goes beyond 66, it only means that a type of permanency of cultivation nurtures.

So here,

R = Number of years of farming

C = Cropping pattern in years

F = Fallow period

$$\text{Therefore, } R = \frac{1 \times 100}{1 + 1} = 50$$

In the present study the R value is <66 which indicates that the residents have inordinate trust regarding the natural skill to prepare productive land. However, the total region is a mining hub and it is impossible for the local residents to expect a fertile land which will be helpful for the growth of agriculture. Due to mining not only the territorial sector is degrading, on the other hand, the absence of eco-friendly

insects are also decaying the intensity of cultivable land. So the idea of a fallow period is certainly intensifying the land utilization in a more progressive manner.

6.4. Input and Output of Production

Mining is also crowding out agriculture through competition for necessary inputs. This is highly pertinent as mining has been linked to land grabbing and increases the cost of living. From here it can be assumed that either phenomenon could lead to an increase in agricultural input prices or production costs. To further explore this, an attempt has been made to analyse the local input prices and also tried to find out the changes that have been taken place in the application of agricultural inputs at the mining affected villages of Ib valley.

Agriculture necessitates a set of inputs such as seeds, fertilizer, pesticides, bullock/tractor, labourers, irrigational facility etc. to achieve the output i.e. production. Each of these input have their share of significant contribution for agricultural production. For example, without seeds one cannot even think about agriculture and without sufficient water crops cannot grow. So the amalgamation of all the inputs is a necessary embodiment for cultivation. In the present study, it was observed that during pre-mining period the output was apparently more than the post mining phase. The agricultural inputs such as seeds, fertilizer, pesticides, labour charge and labour days were comparatively fewer all through the pre mining phase. But this scenario is perversely different in the post mining era. However, majority of agricultural lands were already taken by MCL for mining and the local residents are relying primarily on mining related activities for their survival. Though mining is not at all a primary source of occupation, still a trivial clutch of local residents are practising it. Although varieties of crops are in practice in this district, but the inhabitants of Ib valley are practising rice predominantly. The detailed input and output scenario of both mining and control villages is given in the Table No. 6.2.

6.4.1. Cultivated Area and Crop Production

It has already been discussed that agriculture was the primary source of occupation for the residents of Ib valley. But mining has seized both the cultivated area and production of crop. During field survey it was noticed that, after the intrusion of coal mining industry the total agricultural land of the mining affected communities is very

less in compare to pre mining phase. The local residents were already handed over their agricultural land for the purpose of mining and very few households are practising cultivation. However, the production of mining affected villages is very less in compare to pre mining phase. Even the production of control villages is relatively more and it has a positive resemblance with the pre mining era (Table No. 6.2). Our estimation shows that the total production in mining affected regions decreased to 56.81 percent in compare to pre mining phase.

Production is inversely linked with pollution. This implies that higher is the pollution the production will go down. This statement can be justified by citing the air and water pollution scenario of Ib valley. Study done by Ministry of Environment and Forest in the year of 2013 shows that, during 2012-13, the release of total suspended particulate matter (TPM) at Ib valley was 8042.847 tonnes (MCL, 2013). Although the MCL authorities clarified that they are undertaking some precautionary measures such as mobile water sprinklers to control the level of air pollution, but the reality is something very different. Even the pollution of water bodies on the agricultural land is a constant barrier of cultivation. This can be analysed from the Table No. 6.2.

Table No. 6.2: Changes in Cropping Pattern

Items	**Mining Affected Villages**		**Control Villages**
	Pre Mining	Post Mining	
Total Cultivated Area (in acre)	1186	122	272
Total Production Charge (Rs/acre)	4434.90	12515.63	7157.14
Average Production (quintal/acre)	12.09	6.88	11.54
Average Market Price (Rs./quintal)	418.46	1000.00	1000.00

Source: Field Study

The above Table (No. 6.2) shows that prior to mining not only the total cultivated area was much higher but also the average production per acre was more. This shows that mining has direct negative impact on agricultural production. Even after following a fallow period of one year the mining affected villagers are not able to produce the requisite amount of crop as it was before. However, the situation of control villagers is somewhat similar with the pre mining phase.

6.4.2. Seeds

Seed is the basic object for cultivation (Mallick, Ejnavarzla &Reddy, 2011). Without seeds no agriculture would be possible. In the present study, the mining affected residents are wiping 51.41 kg of seeds per acre. But in the pre mining phase the use of seed per acre was 39.49 kg. As the production is being reduced, the mining affected villagers are consuming more seeds to get more than 10 quintals of crop per acre. But the production is still very less in compare to pre mining situation. However, the situation of control villages is quite similar with pre mining situation. The acre wise requirement of seed is 38.86 kg (Table No. 6.3).

6.4.3. Fertilizers

Farmers depend on fertilizers to increase their production. It can either be natural or chemical. During field study, it was found that the mining affected villagers are spraying varieties of fertilizer such as DAP, Gromer, and Urea to increase the productivity of soil.

Rationally, the continuous release of pollutant particles has decreased the fertility of land and without the use of fertilizer agriculture would not be possible. So the average amount of fertilizer used for one acre of land is 20.16 kg. Although it is an individual choice for the households regarding the practise and expenditure of fertilizer, but most of the households are in favour of spreading DAP and Gromer which costs an average amount of 299.94 rupees per acre. In contrary to this, the control village households are using indigenous manure and only some elite group cultivators are using DAP, Gromer and Urea on their agricultural land. But the proportion is comparatively less than the mining affected villages (Table No. 6.3). However, the pre mining phase has some resemblance with the control villages, because in the pre mining period, the use of chemical fertilizer was far away and the farmers used to buy local compost to nourish their agricultural land.

6.4.4. Pesticides

Pesticide is an ingredient mostly used by the farmers' communities for destroying the harmful pests and diseases (OAS, 2011-12). However, the residents of Ib valley are practising Kharif season crops which entirely depends on the arrival of south-west monsoon, and at the same time it is also exposed to varied agro-climatic sensitization.

Hence, the use of pesticide is precisely regular and frequent among the inhabitants of Ib valley. But the mining affected communities are disbursing more pesticides rather than the control group residents. It was observed that, pesticides such as Anilophos and Roga are widely used among mining affected communities and they are spending an average amount of 289.22 rupees. On the other hand, the use of pesticides was comparatively less i.e. 47.63 rupees in the pre mining phase (Table No. 6.3).

6.4.5. Means of Production

A shift was noticed in the means of production too. Arguably the mechanisation of agricultural apparatuses has ceased the traditional means of cultivation. Prior to mining, the rural people were entirely dependent on bullock and bullock cart to carry out cultivation. Starting from the tillage of land to harvest, the assistance of bullock was rationally ostensive. But the post-mining era has decreased this practice. Now the residents are hiring tractor to accomplish the same endeavour within some limited hours. The reason behind this change mostly is of two types. The first reason behind this is the decrease of live stocks especially bullocks. However the factors such as absence of grazing land, pollution of water bodies and unnatural death due to diseases are the causes behind the reduction of bullocks. The second reason behind this is the time factor. Usually, bullocks were habituated to consume more time and labour in compare to the modern means such as tractor. Therefore the average use of tractor is more prevalent in the post mining era. On the other hand, the control group residents are still relying more on elementary means of farming. Detailed information regarding this is given in Table No. 6.3.

6.4.6. Labour Pattern

As per the labour unit is concern, the pre-mining era was witnessed the engagement of high labour force in agriculture. But in the post mining phase the manifestation of agricultural labourer is very less. As mining is providing a continuous source of occupation which the seasonal agricultural practise cannot provide, the labour force is more intended towards mining activities. Even the average labour price is more in the post mining phase of mining affected villages. In contrast to this, the control villages were reportedly engaging more labourers in agriculture (Table No. 6.3).

It is clear from the above mentioned discussions that, due to mining, the agricultural lands are less fertile and the production from this domain is quite low. Table 6.5 indicates a detailed scenario of inputs regarding mining affected and control villages. It is clearly visible that the mining affected households are applying more inputs and in return they are not at all fortunate enough to avail the actual output. On the other side, the control villages occupied a better posture as the average input ratio is comparatively less than the before said villages. Since the production is visibly more it can be assumed that the control villages are more fertile in compare to the mining affected villages. This reinforces the confidence that agriculture is going through a rough path after the initiation of mining activities.

Table No. 6.3: Summary Statistics of Input and Output

Variables	Mining Affected Villages								Control Village			
	Pre- Mining				Post-Mining							
	Mean	SD	Minm	Maxm	Mean	SD	Minm	Maxm	Mean	SD	Minm	Maxm
Production (qtl/acre)	12.9	1.078	10	13	6.88	1.431	2	8	11.54	1.099	10	13
Seeds (kg/acre)	39.49	1.232	35	40	51.41	2.284	50	55	38.86	2.433	35	45
Seeds Charges (Rs)	7.22	.418	7	8	14.41	.979	12	15	11.69	1.222	10	13
Fertilizer used (kg/acre)	11.04	2.161	10	20	20.16	2.002	15	25	11.64	1.850	10	15
Fertilizer Charges (Rs)	74.56	41.171	10	200	299.94	157.199	120	635	124.37	78.431	45	450
Pesticides Charges (Rs/ltre)	47.63	17.104	20	100	289.22	192.493	110	950	149.84	91.042	50	400
Bullock (days)	64.17	31.261	20	155	11.50	5.745	8	20	79.85	36.678	30	150
Tractor (hours)	2.34	1.312	1	9	6.28	2.899	3	14	1.80	.694	1	3
Tractor Charges (Rs)	252.91	50.061	200	300	925.93	42.450	900	1000	814.08	22.651	800	850
Hire Male Labour (days)	63.99	33.146	6	170	18.25	24.151	4	80	43.77	20.776	20	90
Hire Female Labour (days)	49.42	22.778	4	110	16.63	19.352	3	70	31.32	13.733	10	60
Male Labour Charges (Rs)	49.90	.716	45	50	157.19	4.568	150	160	128.49	13.643	120	150
Female Labour Charges (Rs)	30.63	1.658	30	35	116.87	7.378	100	120	104.91	8.687	100	120
Total Production Charges (Rs)	4434.90	436.767	4000	5500	12515.63	2960.722	8000	17000	7157.14	689.165	6000	8500

Source: Field Study

6.5. Alteration in Agricultural Production

Impact analysis cannot be fulfilled without analysing the amount of loss incurred during the entire course of endeavour. Though it is clear from the above said discussions that mining activities are entirely responsible for the loss of production, still the magnitude of loss is yet to be discussed. So the present section analysed the degree of loss incurred in the mining affected villages. It will also focus on the present scenario of control villages. Arguably, the alteration in agricultural production is strongly visualised. In order to analyse the difference between mining affected and control villages, the recent productivity quotient of both the groups (i.e. mining affected and control villages) were measured carefully. As per table No. 6.3, the total production charge of mining affected villages is more than the control villages. So it depicts that, the input of affected unit is consuming more attention but the output ratio is declining its courtesy. In this regard, the shift of output unit was analysed. As per the recent analysis, mining has utmost negative impact on agriculture. So the native residents are not willing to practise any farming activity. Table No. 6.4 is showing the variation on the entire cultivated area and production in quintal of both mining affected and control villages. In order to calculate the loss of production, at first the difference of average production between two units was calculated and then it was multiplied by the current market price of paddy. Notwithstanding, the current market price of paddy is same in both the regions.

Table No.6.4: Alteration in Agricultural Production

Variables	Mining Affected Village	Control Village
Average Production per Acre	6.88	11.54
Market Price of Paddy	1000	1000
Loss of Production	4.66×1000	----------
Loss in Rupees	4660	----------

Source: Field Study

6.6. Conclusion

Considering the discussion on the present chapter, it can be strongly concluded that the alteration of agricultural production is due to mining. The acquisition of cultivable land by MCL and various faces of pollution are the causes behind non-practice of agriculture. The households who are still practising it are not very regular into this activity. Even after following a fallow period to regenerate the soil fertility, they fail to contend the expected output. However, the mining affected residents are no more practising agriculture as their primary source of sustenance. Rather they have greater reliance on mining generated occupations. But the expansion of mining is also grabbing the residents of neighbouring states to avail employment opportunity which in turn is causing the environment of over population. Mining has already ceased other occupational opportunities such as collection of MFP, practice of diary and fishery, and income from CPRs. So for now mining is the only source of occupation for them. Conversely, the natural resources are decaying on a regular basis and at the same time pollution is decomposing varied health issues. Above all, this whole man-made adversity is embracing multiple tragedies on the whole universe of the commons of Ib valley coalfield.

Despite of positive implications on some aspects of livelihood, mining has potential negative impacts on agriculture. Next, to agriculture, it has sheer negative impact on the health of local residents. So, the next chapter will analyse the impact of mining on health.

Chapter-VII
Mining and its impact on Health

7.1. Introduction

Mining necessitates appropriate planning, suitable execution, apparent impacts (negative/positive) and possible mitigation measures as it shades long-term effects through short-term benefits (Saleque, 2008). Usually mining involves different stages which begin from mineral ore exploration and windup with post-closure period. Each stage implicates dissimilar environmental impacts (Gualnam, 2008). Since beginning till the end mining encompasses the decrease of water level, release of toxic materials including fly ash and dust, pollution of the water bodies and air, degradation of biodiversity, practise of deforestation etc. which endures a direct negative impact on the health of each and every living being (Saxena et al. 2002; Rasmussen and Koroleva, 2003).

The growing uncertainty regarding the health impact of mining industries coincide with a debatable phenomenon concerning the exploitation of mineral resources and conservation of environmental solidity. Consequently, the mining activities are stirring towards national development by tackling the environmental stability which in turn accustoms the foundation for inimical health (Moffat, Phillimore, Bhopal & Foy, 1995). The unfavourable environment not merely emphasises the hostile condition of the living beings but it also leads both chronic and acute health stigmas (Pless-Mulloli et al. 1998 and Altmann et al. 1999).

Health can be defined "as a state of complete physical, mental and social well-being of an individual, and not merely the absence of disease and infirmity" (World Health organisation, 2005). But in a mining set-up the definition of health is absolutely unjustifiable as it incorporates to overcome the potential negative impacts driven by mining itself. By no means, mining can ascertain itself environment friendly as the minerals are predetermined in nature and also non-renewable. However, the well-designed and well-managed mines are also fuelling undesirable 'environmental foot-prints' (CSE, 2006). The widespread damage of environment point outs severe chronic and acute health implications both in case of human beings as well as other living organisms such as flora, fauna and live-stocks.

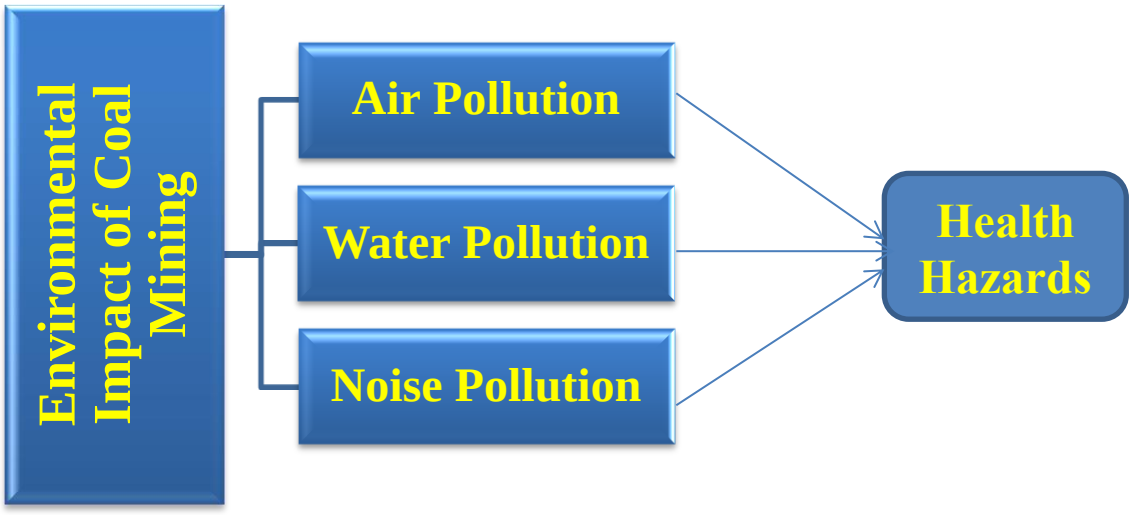
By keeping the above discussed threats in mind the present section is an attempt to analyse the potential negative impacts of coal mining on the health of rural people in Ib valley coalfield. So the present section will analyse the following aspects:

- ❖ The reasons behind the prevalence of health issues
- ❖ The frequency and occurrences of health harms
- ❖ The socio-economic cost of health

7.2. Reasons behind Vulnerable Health

Coal mining is associated with several ecological and environmental impacts which have direct negative impact on health. Despite of phenomenal development in the ways and means of mining techniques, the authorities are unable to control the environmental hazards which are impending out all through mining activities. As it is mentioned earlier that mining necessitates different stages for its accomplishment, each stage is responsible for the emission of several pollutant particles towards air, water, noise and land. And in turn the amalgamation of these toxic elements is accountable for the acute and chronic health hazards.

Figure 7.1: Reasons behind Health Hazards



The above figure (No. 7.1) is clearly depicting the whys and wherefores behind health hazards. As the pollution of air, water, noise and land is responsible for severity of health, each pollutant carrier will be analysed in detail to draw a significant inference.

7.2.1. Air Pollution

Coal mining has a direct negative impact on air. However, the major cause of air pollution in opencast coal mines is the release of total suspended particulate (TSP) matter and respirable particulate (PM_{10}) matter (Sinha and Banerjee, 1997). During mining operation the activities such as drilling, blasting, movement of vehicles, transportation etc. usually emits particulate matter and smokes which are responsible for ecological imbalance and affects the health of living beings (TERI, 2013a). Study done by Katoria, Sehgal and Kumar (2013) expounded that majority of the opencast mines are responsible for the emission of fugitive dust to the air. According to them a coal stack of 50,000 tonnes is responsible for the emission of 250 tonne of fugitive dust. The central source of fugitive dust is the vehicular traffic of the haul roads all through the process of transportation (Cowherd, 1979). The combustion of coal which produces carbon dioxide (CO_2), sulphur dioxide (SO_2) and oxides of nitrogen (NO_x) to the environment of the adjacent mining activity is also the second major source of air pollution (Zhengfu et al, 2010).

Particulate Matter: The combustion of coal releases particulate matter which is of two types i.e. small particles less than 2.5 micrometres ($PM_{2.5}$) and larger particles up to 10 micrometres (PM_{10}). In comparison to $PM_{10,}$ the movement of $PM_{2.5}$ is more resonant into air network and posing countless hazards to human health. According to the U.S. Environmental Protection Agency, emission of particulate matter to the air environment is responsible for the respiratory disorder which causes asthma and other chronic obstructive pulmonary disease (COPD). The cases of cardiovascular diseases and deaths are also associated with it. Even the long-term exposure with suspended particulate matter can cause lung cancer (UIC, 2013).

Table No. 7.1: Estimated Annual Health Impacts and Health Costs due to PM Pollution from the Coal-fired Power Plants in India (2011-12)

Effect	Health Impact	Health Cost (crores of rupees)[a]	Health Cost (million USD)[b]
Total Premature Mortality	80,000 to 115,000	16,000-23,000	3300-4600
Child Mortality (under 5)	10,000	2100	420
Respiratory Symptoms	625 million	6200	1200
Chronic Bronchitis	170,00	900	170
Chest Discomforts	8.4 million	170	35
Asthma Attacks	20.9 million	2100	420
Emergency Room visits	900,000	320	60
Restricted activity days	160 million	8000	1600
a – one crore = 10 million & b – using conversion rate of 1 USD= 50 rupees			

Source: Greenpeace Report on "Coal Kills: An Assessment of Death & Disease caused by India's Dirtiest Energy Source", 2013.

The above table (No. 7.1) shows that during 2011-12, the emission of PM pollution from India's coal-fired power plants is responsible for 80,000-115,000 premature death and 20.9 million asthma patients. The study also describes the cases of chronic bronchitis, chest discomforts, emergency room visits and regulation on movement due to these health issues. According to this report, the monetary cost accompanying with these health impacts surpasses 16,000-23,000 crores per year.

Sulphur Dioxide: In the same way, emission of SO_2 is responsible for the increase of respiratory symptoms. When the nearby communities are getting exposed to SO_2 they are suffering with diseases such as asthma, bronchitis and sometimes they are facing difficulties regarding lung function (UIC, 2013).

Oxides of Nitrogen: Oxides of nitrogen (NO_x) are the by-products of fossil fuel combustion from automobiles and coal-fired power plants. Similarly, exposure to nitrogen oxide (NO_x) is responsible for viral and bacterial infections. When any asthmatic person comes in contact with NO_x they used to foster breathless and cough within themselves (UIC, 2013).

As air pollution is a direct product of coal mining, Ib valley coalfield is not an exceptional case of this. Study conducted by MoEF at 88 industrial clusters of India described that the districts such as Dhanbad, Korba, Angul, Talcher, Jharsuguda and Singrauli are the critically affected regions of air pollution due to coal mining (MoEF,

2009). Though the district Jharsuguda is an industrial hub, at the same time the dominant industrial activity of this district is the extraction of coal at Ib valley coalfield. The emission of PM_{10}, SO_2 and NOxduring coal extraction, blasting, drilling, sizing, loading and unloading of coal and overburden, transportation etc. has a direct negative impact on health of flora and fauna of this mining belt (Chaulya, 2004a). According to the Pollution Control Board of Odisha, the level of SO_2 and NO_2 is under the prescribed limits but the absorption of suspended particulate matter (SPM) in and around the mining regions is a matter of concern. Predominantly, the emission of fugitive dust during mining operation is responsible for health hazards in and around Ib valley coalfield (TERI, 2013b). A study done by Chaulya on the assessment and management of air quality at Ib valley coalfield pronounced that the annual average of SPM in both the residential and industrial areas is going beyond the National Ambient Air Quality Standard (NAAQS) protocol. According to the study, the 24-hr annual average of total suspended particulate matter (TSP) and PM_{10} at all the monitoring stations is higher than the respective criteria of NAAQS (Chaulya, 2004b).

AS per the Annual Sustainability report of MCL, dust is the primary source of air pollution at Ib valley coalfield. While agreeing with the level of pollution, the report described the various causes of air pollution over there. This includes drilling, blasting, transportation, loading and unloading. At the same time it also authenticated the study done by CMRI Dhanbad regarding the emission of contaminating dusts. The reported concluded that, during 2012-13 the total emission of TPM at Ib valley was 8042.847 tonnes. But at the same time it argued that TPM is not at all airborne and it is not causing any kind of health hazards. Even it clarified that MCL is following certain measures to control the particulate matters. The measures include fixed sprinklers and mobile water sprinklers. As per the report, the authorities are sprinkling water on the dust of road and also near the operation site and through this process they are minimizing the pollution of air.

However, during field study, the researcher visited the adjacent mining regions as well as travelled daily in the busy roads of mining to reach the affected villages. In course of time, it was observed that, the provisions are limited only to the pen and papers. Neither the water sprinklers are doing their work regularly, nor are the coal loaded trucks covered by tarpaulin at the time of transportation. So the emission of

coal dust is getting stagnant in the surface of roads, trees, roadside junkyards, and the nearby water bodies. According to the nearby residents, the water sprinklers are sprinkling water twice or thrice in a week and also no such regularity is there. This can be visualised from Figure No. 7.2 to 7.5. These figures are showing the condition of roads, road side junkyards, trees and uncovered trucks. So it is worth mention here that, the emission of coal dust is typically responsible for the pollution of air at Ib valley which in turn accountable for varied health hazards.

Figure No. 7.2 to 7.5: Air Pollution Scenario at Ib valley

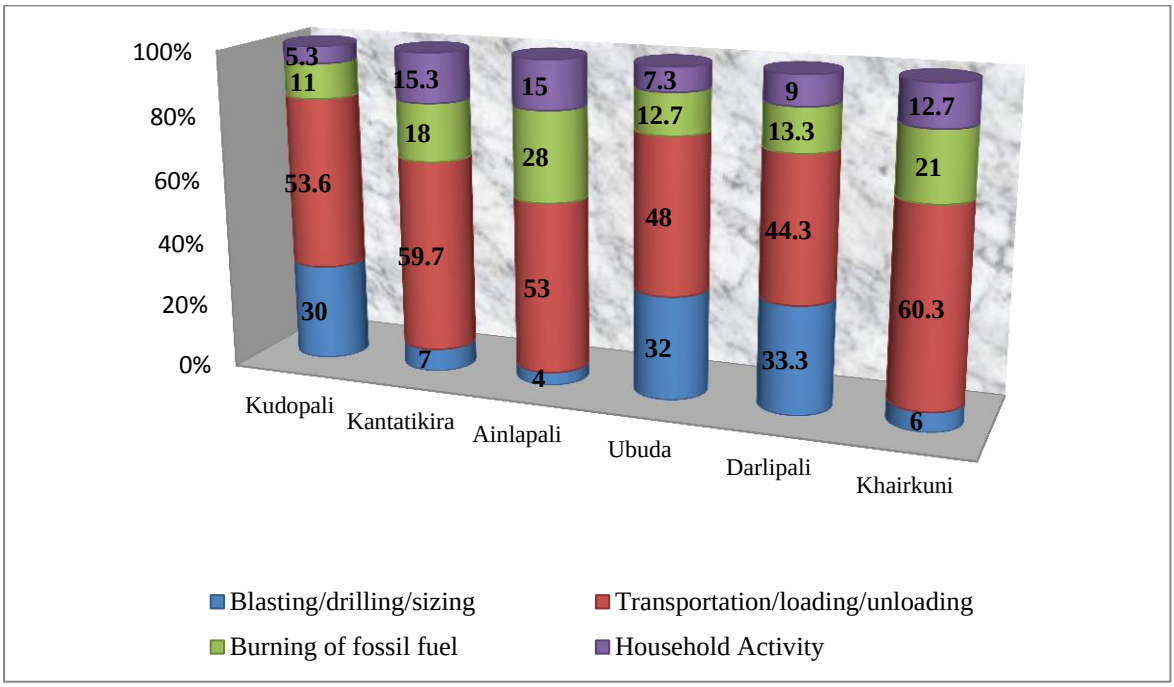
Source: Field Study

According to the mining affected villagers of IB valley, air pollution is a regular threat. When they were cross questioned regarding the reason behind pollution of air, they replied that every day the extraction of coal and its associated activity such as drilling, blasting and transportation are the central sources of air pollution. The

villages like Ubuda, Darlipali and Kudopali are the most vulnerable segments. These three villages are very close to the mines and the dust from the mining operation is making their life hell. This can be analysed from Figure- 7.2. As the control villages are not affected by any kind of industrial activity, they are free from any kind of air related pollution measures.

As per the opinion of the mining affected villagers, the central cause of air pollution is the transportation of coal without any safety measures. Enormous quantities of coal loaded vehicles are moving every day and the authorities are hardly concerned regarding the covering of coal during transportation. Despite this, the emission of coal dust and ash at the time of loading and unloading of coal is also the cause of air pollution. As discussed earlier, Kudopali, Darlipali and Ubuda are barely 50-100 metres away from the active mining zone, so these villagers are the worst sufferers of air pollution during blasting, drilling and sizing of coal (Figure- 7.2).

Figure 7.6: People's Perception Regarding the Cause Air Pollution



Source: Field Study

The third major reason behind the pollution of air is the burning of fossil fuels during the transportation of vehicular assets i.e. cars, heavy duty trucks, dumpers etc. And at last, the villagers replied that they are using coal to prepare their food stuffs in a

regular basis. So the emission of dust and smoke during the period of food preparation is also a severe cause of air pollution.

7.2.2. Water Pollution

Water is an essential ingredient for all the living beings across the globe. But the growing concern regarding industrialisation such as mining is bringing pollution of water regimes as they are disposing their waste particles into the adjacent water bodies (Reza and Singh, 2010). The waste particles are not only polluting the water quality but also altering the biological, chemical and physical nature of the aquatic system (Sangodoyin, 1991). However, the release of waste particles is determined by the nature and process of mining. At the same time, the presence of major form of toxic waste in a coal mining region is the contamination of water by coal dust and ash. Even it creates water level deficiency as every day mining necessitates gallons of water to carry out its operation. Coal mining is not only responsible for the deficiency of water quality but it also humiliates the pH balance of the neighbouring water bodies. Further, the release of surplus unit metallic substances from the mining yards which contains iron (Fe), copper (Cu), manganese (Mn) and nickel (Ni) is declining the routine domestic activities of water (ibid, 2013).

Above all the release of acidic water from mining is the major cause of water pollution all around the mining yards (Singh, n. d.). Study done by Swer and Singh at Jaintia Hills of Meghalaya revealed that the adjacent water bodies are critically affected by contamination of Acid Mine Drainage (AMD) from the nearby coal mines as it contains sulphate, iron and other toxic heavy metals. The concentration of coal particles, sand, soil and contamination of AMD are the central causes of alteration in water colour from brownish to reddish orange. Even the acidic water is responsible for the hazardous condition of the aquatic life as it contains low pH balance (Swer and Singh, 2004).

In the present study, while interacting with the officials of Ib valley coalfield it was observed that they are disposing the waste water of Ib valley area to the nearby Ib river which is a tributary of Mahanadi river. On the contrary, the officials of Lakhanpur area revealed that they are disposing their waste water to the nearby *Lilari nallah* which is again a tributary of Ib river. Study done by Panda, revealed that an

average quantity of 98000 crore litre polluted water is discharged from mines of Mahanadi Coalfields Limited (MCL) round the year (Panda, n. d.). Another study conducted by Mishra at Basundhara area of Ib valley coalfield revealed that the concentration of pH, total dissolved solids (TDS), electrical conductivity (EC), calcium (Ca+2) and magnesium (Mg+2) in the water bodies i.e. bore well, open well and pond is above the normal prescribed range. These metallic substances are leading the health hazards such as cardiovascular and heart diseases, high blood pressure, high cholesterol level, arthritis, diabetes, kidney stones, urinary incontinent etc. (Mishra, 2012). +

The routinely release of waste materials to the Ib river is the central cause of water pollution in this belt. Even the discharge of fly ash and coal dust during mining activities including blasting and sizing are the major causes of contamination of adjacent water regimes. The ponds and streams which were considered as the central source of water for bathing, washing and livestock use is now filled with coal dusts. The villagers of Kudopali, Ubuda, and Darlipali are suffering much as these villages are barely 50-60 metres away from the active mining region. Though Kudopali and Ubuda village has their own ponds inside the village, the water quality of these sources are typically black in colour as these villages are surrounded by Samaleswari and Lakhanpur opencast mines respectively. This can be analysed from the following figures (Figure No. 7.7 to 7.10).

Figure No. 7.7 to 7.10: Water Pollution Scenario at Ib Valley

Figure 7.7: Village pond Kudopali

Figure 7.8: Lilari *Nallah* of Darlipali

Figure 7.9: Village pond of Ubuda

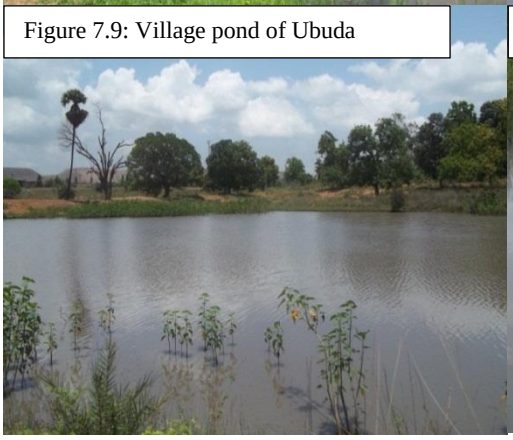
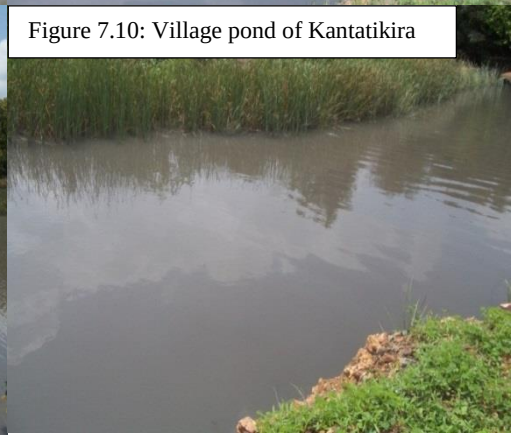


Figure 7.10: Village pond of Kantatikira



Source: Field Study

In this context the situation of Darlipali village is eye-catching. It has already been discussed in the previous chapters (chapter-4 and 5) that these villages are surrounded by three opencast mines; they are disposing their waste water in to the *Lilari nallah*, the only source of water for bathing and other household usages. The situation can be analysed by taking the following focused group discussion (FGD) session.

While doing the field survey through interview schedule the researcher conducted varied FGDs in the respective sample villages. During the FGD session of Darlipali village, the villagers were found irresistible by explaining their struggle with coal dust, ash and blasting. According to them, they are used to the tragedies of three opencast mines i.e. Belpahar OCP, Lakhanpur OCP and Lilari OCP. But the release of waste water to their only water source is deteriorating their health conditions day by day. As they don't have any choice to avail the water for performing their daily activities they are bound to use the water of Lilari Nallah. Everyone has identical assertion that after taking bath in the contaminated water, they used to feel itching all over the body. They are experiencing red coloured allergies all around the body almost every day. The children are the worst sufferers of this allergic stuff as per their feedback. Even the issues such as eye-allergy, sneezing, cough and diarrhoea are the routine health complications of this village. (FGD 7.1)

The above mentioned issue is very pertinent among the mining affected villages of Ib valley coalfield. The prevalent health issues are not only because of the pollution of ponds and streams, but the drinking water sources are also getting contaminated by release of waste coal substances. According to the study of Senapati and Behera, at Ib valley region, the concentration of Manganese (Mn), Cadmium (Cd) and Lead (Pb) were found more in quantity from the water samples of dug wells and tube wells of active mining zones. The Table No 7.2 will describe the presence of metallic substances in the sample water of Ib valley coalfield.

Table No. 7.2: Comparison of Trace Element Concentration (In Ppm) In Ground Water of the Study Area with Indian Standard Drinking Water Specification (BIS 10500: 1992)

Element	Highest Desirable Limit (BIS 10500:1991)	Maximum Permissible Limit (BIS10500: 1991)	Range of Concentration in Ib-Valley Area
Mn	0.1	0.3	0.28 – 0.48
Cr	0.05	0.05	BDL – 0.03
Zn	5	15	0.06 – 2.09
Cd	0.01	0.01	0.01 – 0.03
Co	------	------	0.01 – 0.09
Ni	------	------	BDL – 0.09
Cu	0.05	1.5	0.01 – 0.08
Pb	0.05	0.05	0.01 – 0.08

Source: "Study of Selected Trace Elements in Coal and Ground Water of the Ib-valley Coalfield of Odisha, India and their Possible Impact on Human Health" by A. Senapati & P. Behera, 2012.

From the above Table (No.7.2) it is clearly evident that the drinking water quality of Ib valley coalfield is contaminated by different coal particles. However, the concentration of Manganese (Mn), Cadmium (Cd) and Lead (Pb) were found to be beyond the maximum permissible limit in the ground water samples. The possible impacts of these trace elements on human health are as follows. Regular exposure with extraordinary level of manganese is responsible for health hazards such as difficulties with breathing and swallowing, birth defects, low birth weight, bronchitis, euphoria, impotency, speech disability etc. (Dara, 1993). Similarly the high concentration of cadmium (Cd) in water can develop rheumatic symptoms as it replaces the calcium in bones. On the contrary, the presence of lead can directly affect the central nervous system and cardiovascular system. In most of the cases the

children and young cohorts are embracing many difficulties such as brain damages, blindness, paralysis etc. (Senapati and Behera, 2012).

Mining is not only responsible for water pollution but it is also equally accountable for water scarcity of the studied region. As mining necessitates huge amount of water to carry out its operation, it is continuously reducing the level of ground water. According to the villagers of every mining affected village, the water table is reducing routinely and it is very difficult to obtain minimum quantity of drinking for their household. The situation becomes tough as the water bodies like ponds and streams are drying and the level of drinking water sources such as tube well and bore well is going down during summer. In addition, the irregular supply of drinking water by MCL authorities and the floating of greasy materials in the supplied water have instigating the villagers to agitate against MCL.

7.2.3. Noise Pollution

Noise is an obvious issue as mining activities are 24 hour continuous process. Noise coming out during blasting, drilling, overburden removal and transportation are the central problems of noise pollution (Saviour, 2012). During the field survey it was observed that blasting is predominantly responsible for noise related health issues. Depending on the requirement of opencast mines, blasting is taking place once or twice a day. But the authorities are not providing alarm before each and every blasting activity. As a result the surrounding residents are facing various life threatening injuries during the intercourse. This can be analysed by taking the following cases.

> Balaram Khamar aging 43 is a resident of Darlipali village. According to him while doing roof reparation of his own house he fell down because of severe vibration. As there is no specific time for blasting and vibration, and unfortunately he did not receive any alarm regarding blasting during that time. The vibration was so severe that he was not able to hold any balance and fell down from the roof. As a result he was injured severely having leg and hand fractures. (Case 7.1)

Bilasini Pasayat aging 38 is a resident of Ubuda village, an adjacent region of Lakhanpur OCP. She was heavily injured once while taking bath in the village as the blasting in Lakhanpur OCP took place. According to her, while having bath, both large and small sized stones and coal particles aroused within a short span of time. The speed of stones and coal particles was so high that she was unable to protect herself and got severely injured by these. (Case 7.2)

The above mentioned case studies are not the only cases of blasting impact but the local residents are confronting small to severe accidents while doing their day to day activities. The irresponsible attitude of the concerned authorities is becoming harmful for the innocent people. During field work it was observed that the complaint registered by the villagers regarding blasting has not brought a permanent solution. The authorities are playing hide and seek game with the villagers.

Even they provided alarms and minimised the noise mostly during evening and night hours when every working individual wish to relax and sleep. But only after few days they are repeating the previous situation. Blasting has also sheer negative impact on housing pattern of neighbouring residents. The pucca houses are facing cracks and the owners of kutcha houses are losing their houses due to blasting. So the repairing cost of houses are shading extra burden on the residents. The impact of blasting can be traced by analysing the figures from 7.11 to 7.12.

Figure No. 7.11 to 7.12: Blasting Scenario at Ib Valley

Source: Field Study

From the above figures (No. 7.11 to 7.12), it is evident that blasting has severe negative impact on housing pattern. The noise and vibration that is coming out of the nearby mines at the time of blasting is shading a permanent negative impact on the houses of mining affected villages. Even the noise has severe impact on the children folks of all the mining affected villages. The school teachers of Darlipali, Ubuda, Kudopali and Khairkuni villages revealed that the movement of vehicles all through the day is disturbing their class room teaching. The noise coming out of the movement of the vehicles and blasting has disturbed the mental condition of the children. It has ruined their concentration on study.

7.3. Frequency and Occurrences of Health Harms

As discussed above coal mining in the Ib valley region is responsible for the release of various toxic materials which have a direct impact on the health of local inhabitants. The discharge of mining substances is not only degrading the air, water and land but also is responsible for various kinds of acute as well as chronic diseases. According to the villagers the use of toxic materials and heavy machines, long period of extraction, deforestation, movement of heavy vehicles, discharge of waste coal particles etc. are the reasons behind their hazardous health. In the present study, a total of 400 households were interviewed. Of them, 300 mining affected households were studied. The awful occurrence which the researcher found that, every mining affected household is suffering from same or different kinds of diseases. Not a single household is free from mining related diseases. Since the inception of opencast mines every household is unwantedly embracing air and water borne diseases mostly.

Along with all the employees, the local inhabitants are suffering from air and water borne diseases. However, MCL is providing health care facilities to its employees only. Others are not fortunate enough to bear their health costs. As a part of its CSR activities, the non-employees can visit the central hospital of MCL and consult the doctor in outdoor with a subsidised fee. Nothing beyond is taken care of. Sometimes, the MCL authority organises some health camps in its affected areas. But, it is not sufficient to bear the cost of their illnesses. All the local inhabitants are unwantedly exposing themselves towards the polluted air, water and noise. So the continuous exposure towards these by-products of mining is responsible for diseases such as tuberculosis (TB), asthma, malaria, varied skin diseases, diarrhoea, high blood

pressure, gastrointestinal infection etc. To draw a clear picture about the frequencies and occurrences of diseases in this belt, data was collected from the nearby Community Health Centres (CHCs). But the unavailability of office staffs and lack of infrastructural facilities are the barriers for the CHCs to maintain the record regarding each and every diseases of the concerned region. However, they retain the records about major health problems of their respective zones.

The table no. 7.3 shows the hospital wise data on TB, asthma, malaria and skin diseases. As per the hospital records, the numbers of TB patients in Lakhanpur, Rajpur, Khaliakhan and Belpahar CHCs are very high in comparison to Kasuraloi CHC. When asked the hospital staffs regarding this issue, they replied that the patients from Kudopali, Kantatikira, Ainlapali, Ubuda, Chharla, Lajkura, Banjhipali and Darlipali are coming more in numbers. As these villages are within 1-2 kilometres of radius of active mining regions, the continuous release of dust during blasting, overburden removal and transportation are the major causes of TB. The same reason is also applicable for the occurrence of asthma among the mining affected communities.

Malaria, is the parasitic infectious disease, is usually transmitted by mosquitos which can breed both in the polluted and fresh water. The ill-effects of malaria infection are fever, headache, muscle ache vomiting, diarrhoea, anaemia, tiredness, jaundice etc. However, the severity of malaria infection can also lead to kidney failure (WHO, 2015). Opencast mines of both Ib valley and Lakhanpur area are discharging massive amount of waste water to the nearby water bodies. As the mining authorities are not paying any attention to clean the water bodies, the long period of stagnation of polluted water is accommodating the mosquitos to breed and spread the infection.

During the field survey, it was observed that Belpahar and Brajrajnagar are the worst polluted regions of Ib valley coalfield. As these two regions have railway connectivity, thousands of coal loaded trucks are moving for the purpose of export through railways. The condition of roadways is not that good as it has big and small dumps all the way through. As the mining authorities are not much attentive to cover up the coal loaded vehicles, the emission of coal dusts are getting stagnant in the road side junkyards. Mostly during rainy season, the amalgamation of coal dust and rain

water is giving birth to the mosquitos. This is the major reason behind more number of malaria patients at Belpahar CHC.

The release of dust particles in to the water and air is increasing skin diseases and eye-irritation in a regular basis. According to the hospital authorities, skin disease is not a seasonal disease but this can be treated as a daily disease. The local populace is adapted with the diseases and whenever they are experiencing much discomfort, they are approaching the hospital authorities for medication.

When contacted the medical authorities of MCL, they too revealed that the occurrence of malaria and skin diseases are high in number. The number of TB and asthma patients is comparatively low. According to the then chief medical in-charge of occupational health department, mining has direct impact on respiratory tract and lungs. During the conversion he revealed that 'pneumoconiosis' is the direct product of coal mining. As per his opinion, the people who are working in the coal mines or near the coal mines and are having the exposure of at least 10 years can develop this disease. According to Centre for Disease Control and Prevention (CDC) pneumoconiosis is a black lung disease caused by the inhalation of dust and this can cause lung impairment, disability and premature death. However, this is purely man made and can be avoided by developing appropriate dust control measures. In accordance with the chief medical officer (CMO) of Ib valley the number of persons having pneumoconiosis was 3 during 2009 and 2010 and 4 during 2011.

Table no. 7.3: Hospital wise Data on Diseases

Name of the CHCs	Year of Occurrence	TB	Asthma	Malaria	Skin Diseases
Lakhanpur CHC	2010	86	111	188	980
	2011	84	93	151	1534
	2012	31	61	35	452
Rajpur CHC	2010	80	101	80	501
	2011	95	79	87	511
	2012	60	88	90	395
Khaliakhan CHC	2010	105	126	110	18
	2011	81	86	121	17
	2012	70	47	81	40
Belpahar CHC	2010	72	64	461	221
	2011	50	50	322	296
	2012	32	69	124	189
Kasuraloi CHC	2010	4	43	140	89
	2011	8	32	64	96
	2012	9	19	20	100
Central Hospital of MCL (IB Valley)	2010	64	94	461	1731
	2011	21	76	322	1650
	2012	26	101	124	595
Talpatia CHC	2010	------	5	11	21
	2011	------	3	9	16
	2012	------	3	13	20

Source: Medical Record Books of concerned CHCs

On the contrary, data was also obtained from the CHC of control village i.e. Talpatia. According to the doctor of Talpatia CHC they are encountering seasonal diseases like malaria and skin diseases. Though the villagers are satisfactorily aware regarding cleanliness of their village water bodies, the occurrence of water borne disease is somewhat low in their village. Lack of air pollution of this village was also reported and so is the occurrence of air borne diseases. However, the cases of bronchial asthma are not because of any kind of pollution, rather they are genetic.

Despite the hospital authorities, the sample households were also interviewed regarding the prevalence of diseases. Surprisingly, not a single household was disease free. Each and every person of the sample households are suffering from skin disease, gastro-intestinal disease, malaria, arthritis etc. in a regular basis. It was observed that devoid of any age group, people are suffering from mining related health problems. This can be analysed by taking the following case.

> Japi Kumari is a 12 year old girl of Ubuda village. While interacting with her mother regarding health hazards, the researcher got to know that Japi is having chronic diseases like arthritis, TB and gastritis. Besides this eye allergy and skin allergy are the other daily diseases she is coping with. (Case 7.3)

The above mentioned case is merely a single example of prevalence of diseases. Many more cases like Japi Kumari are pertinent in the studied region. However, a detailed analysis about the frequency and type of health problems are given in table no. 7.4.

The Table (No. 7.4) clearly portrays the occurrence and frequencies of diseases at the sample households. While interacting with the villagers it was found that mining has brought serious threat towards the health of local communities. Out of the total sample households majority of the households revealed that arthritis and gastric are the daily occurring disease. Each and every household is experiencing it every day. It has been discussed in the Table (No 7.2) that the presence of Manganese (Mn), Cadmium (Cd) and Lead (Pb) are the main causes behind the prevalence of diseases such as diarrhoea, gastritis, arthritis, high BP etc. It can be assumed that the concentration of Zn, Ca and Mg is probably high in the adjacent water bodies which has resulted these health issues. The concentration of suspended particulate matter (SPM) beyond the permissible limit and the imbalance pH are the causes of high BP, asthma and tuberculosis (TB). Though the rate of frequency varies from daily to

yearly, still the occurrence is permanent (Senapati and Behera 2012b and Mishra, 2013b).

Table No. 7.4: Frequency and Type of Health Problems

Mining Affected Village (Pre-Mining)					
Type of Health Problems	Daily	Weekly	Monthly	Yearly	Total**
Asthma	----	----	----	26 (8.7)	26
TB	----	----	----	11 (3.7)	11
Gastro-intestinal	8 (2.7)	----	26 (8.6)	39 (13)	73
Malaria	----	----	----	78 (26)	78
Diarrhoea	----	----	----	163 (54.3)	163
Arthritis	7 (2.3)	26 (8.7)	61 (20.3)	93 (31)	187
Skin-disease	----	----	----	76 (25.3)	76
High BP	----	3 (1)	59 (19.7)	33 (11)	95
Eye-allergy	----	----	----	----	----
Mining Affected Village (Post-Mining)					
Asthma	41 (13.6)	14 (4.7)	33 (11)	9 (3)	97
TB	---	----	46 (15.3)	121(40.3)	167
Gastro-intestinal	253 (84.3)	19 (6.3)	24 (8)	----	278
Malaria	----	----	103 (34.3)	89 (29.7)	192
Diarrhoea	23 (7.7)	68 (22.7)	103 (34.3)	30 (10)	224
Arthritis	221 (73.6)	79 (26.3)	----	----	300
Skin-disease	300 (100)	----	----	----	300
High BP	133 (44.3)	86 (28.6)	49 (16.3)	----	268
Eye-allergy	300 (100)	----	----	----	300
Control Village					
Asthma	----	----	----	30 (30)	30
TB	----	----	----	11 (11)	11
Gastro-intestinal	3 (3)	16 (16)	27 (27)	9 (9)	55
Malaria	----	----	----	35 (35)	35
Diarrhoea	----	----	10 (10)	22 (22)	32
Arthritis	5 (5)	21 (21)	23 (23)	44 (44)	93
Skin-disease	----	----	----	16 (16)	16
High BP	13 (13)	12 (12)	20 (20)	35 (35)	80
Eye-allergy	----	----	----	----	----
Asthma	----	----	----	17 (17)	17

Source: Field Study

Note 1: Figures in the parenthesis are percentage

Note 2:The percentage was calculated from total sample size of both mining and control villages i.e. % for mining affected villages was calculated from the sample of 300 & % for control villages was calculated from the sample of 100.

***Every respondent were interviewed separately regarding the diseases. All the sample households asked regarding the frequency and occurrence of diseases.*

Out of 300 households, 167 households revealed that they are suffering from TB. The number of TB patients is more in Kudopali and Kantatikira village. Due to improper medication the death rate of TB is also high in this belt. This can be analysed by taking the following FDG.

> During the endeavour of field survey the researcher also conducted several FGDs to draw a clear picture regarding the occurrence of health hazards. Surprisingly, while conducting FGDs at Kudopali and Kantatikira village, the researcher was shocked by knowing the fact that out of 30 villagers in a FGD session at Kudopali village, 28 are suffering with TB. These residents are taking the medication from the nearby Anganwadi centres and from the government hospitals as state govt. is taking the initiative to cure TB absolutely. (FGD 7.2)

In contrary to the present situation, the pre mining phase was quite better. Prevalence of TB and eye-allergy were absolutely absent and the frequency of other diseases like skin diseases, diarrhoea and malaria was seasonal only. While arthritis was due to day long hard work, high BP was because of stress and strain. The situation in control village is more or less same with the pre mining situation. Here also the occurrence of TB and eye-allergy is completely negligent. However, the western part of Odisha is declared as malaria prone, that's why the seasonal malaria patients were reported in the non-mining regions too. Another cause behind the occurrence of high BP and gastro-intestinal disorder is rapid industrialisation. District Jharsuguda is one of the industrial hubs of Odisha. The active industrial units rather than coal mining are Bhushan Steels, Vedanta Alumina, Orissa Power Generation Corporation (OPGC) Limited, TATA Refractories Limited (TRL) and SPS Sponge iron Limited. These industrial entities are engaging the local population in their various production units. As a result a minimal chunk of control group households are being employed either of these industries and continuous exposure to metallic elements is resulting in gastro-intestinal and arthritic health hazards. Although the frequency is very less in compare to mining hubs, still the occurrence exists among them.

7.4. The Socio-Economic Cost of Health Hazards

Health hazards have direct impact on economic stability of a household. As discussed earlier, MCL is providing all kinds of possible measures to its workforce; others are bearing the cost only. So the non-workers are approaching the community health

centres at first but the unavailability of medical practitioners and proper health care facilities forcing them to take the medication of private hospitals/clinics. They losing their work days and are bearing the cost of frequently occurring health threats in the process. Whilst the health hazards are obstructing to earn for livelihood, the social cost is getting affected. Therefore, the economic instability to meet the cost and effect of health hazards is bringing social insecurity among the mining affected people of Ib valley coalfield. The socio-economic cost of health can be analysed in the following two sections:

- ❖ Health Effects
- ❖ Health Costs

7.4.1. Health Effects

Coal mining at Ib valley coalfield has sheer negative effects on health. The entire community is the victim of it. Ever since the inception of mining the neighbouring residents are getting impacted both economically and socially. The first and foremost impact of mining is the social insecurity. The process of displacement, break down of community ties, separation of kin members etc. are the major causes of the disturbance of mental health. Primarily, the rural community have strong emotional bond with the nature, natural resources and agricultural land. The entire structure of rural life has traditional connectivity with the indigenous habitat. But the destruction of these natural assets is causing depression, anxiety and isolation among the residents of Ib valley coalfield.

Besides mental health, the physical health is also an important criterion to procure a secure livelihood. Deterioration of health is a common factor to sustain the means of support. Frequently occurring health traumas are restricting the local people to sustain their sources of livelihood. Even the working groups are losing their jobs due to vulnerable health issues. This can be analysed by taking the following case.

Maharagi Bhoi aging 51 is a permanent resident of Kudopali village. In the year of 1984 he handed over his agricultural land for the purpose of establishment of Samaleswai OCP. In lieu of his agricultural land he got a job at Bundia underground mine. But after 20 years of his engagement with the mines as a drill operator, he developed severe health problems. According to him he had TB, severe fever, body ache and vomiting. In that situation he informed the MCL authorities regarding his ill health and it took eight months to recover from these health issues. In between the period of eight months MCL authorities sent him two notices to report at the chief general manager's office. As per his knowledge, he asked his wife and son to inform the authorities regarding his ill health too. But when he went to join the job after a gap of eight months he got to know that he has been dismissed from job. When inquired about the whole issue, the office bearers told that they didn't receive any oral or written information regarding his absence and after the issue of two notices, they declared him terminated from the job. In this regard Maharagi has lodged a complaint at the head office of MCL and since then, he is running from here to there in the hope to get justice. (Case 7.4)

The above mentioned case of Maharagi Bhoi is not the single case of Ib valley. Absenteeism due to ill health and job loss are predominant in Kudopali and Kantatikira villages. Some of them also complained that MCL authorities are not issuing any notice of termination and are taking whimsical decisions in such situations. When contacted the MCL officials regarding this issue. They were of the opinion that people are not at all serious regarding their jobs and even after several notices, they are not coming to report at the office. Owing to this reason, they are taking strict actions against working community. It can be concluded that the authorities' narration is justified from their point of view but the issue attracts more empathetic attention because of their precarious situation whereby they have been shifted from their traditional livelihood options to an industrial workspace environment. The need and desire for economic determinants are compelling them to work in the precarious atmosphere of mining as it is their only source of sustenance. This is the central issue of working communities at Ib valley coalfield.

Besides the working community of MCL, other villagers are also facing the same issue. Due to ill health, the households are deviating from work places and as a result of loss of work days they are losing their substantial income generating sources. The following table will describe the scenario of health effects at the sample villages.

Table No. 7.5: Average Number of Days Un-well (Month)

Category of Villages		Mean	Std. Deviation	Minimum	Maximum
Mining Affected Village	Pre-Mining	1.40	.536	1	3
	Post-Mining	4.90	2.162	1	12
Control Village		1.48	.559	1	3

Source: Field Study
Note: Figures in the parenthesis are percentage

The above table (no. 7.5) has described the health effects of the sample villages. It is evident that prior to mining the villagers were not affected by any industrial hazards like mining. So they used to maintain good health records. They experienced only normal health issues such as headache, body pain etc. Even they used to recover from the concerned issues in a day or two. But the post mining situation is entirely different. Here, majority of the people are falling ill at least an average of 4.90 days in a month. Even three cases of birth defects were identified at Ainlapali, Darlipali and Ubuda villages. According to the mothers of these children since their birth, they are struggling with stumpy weight, anaemia and speaking and hearing problem. On the contrary, the residents of control villages are barely experiencing any long-term health effects. In the context of occurrence of diseases, they are coming across some sort of seasonal health issues. It shows that mining has some negative impacts on the health of the neighbouring communities.

During the field investigation it was observed that due to pollution the doctors are avoiding their posting in any of the mining affected community health centres. In order to obtain the data on prevailing diseases of critically affected Belpahar region, when the researcher went to the Belpahar CHC she came to know that not a single doctor is being appointed there. When inquired about the cause, the concerned pharmacist of that CHC replied that since three years, not a single doctor was being appointed for Belpahar CHC. The prime reason for non-employment of doctors is the unwillingness of doctors to be posted in these areas owing to the severe air, water and noise pollution of the region. Instead, one pharmacist is taking care of the patients.

7.4.2. Cost of Health Hazards

The cost of health hazards includes the amount of direct medical, direct non-medical and indirect costs. Direct medical cost includes medical expenses of a household such as doctor's fee, medicines and laboratory tests. While a non-medical direct cost contains the travel expenses, and dietary expenses, at the same time indirect costs can be assumed by calculating the loss of work days due to ill health and income lose due to this (Bahl et al, 2004). In order to estimate the total cost of health hazards 400 households were interviewed regarding their monthly expenditure on health. As the neighbouring residents are suffering from both acute and chronic diseases, the situation goes out of control sometimes and the patient need to take admission in the nearby hospitals or clinics.

However, in most of the time, the frequently occurring diseases such as asthma, high BP, arthritis, gastritis, diarrhoea, eye-allergy etc. are also leading hospitalization as the effect of these diseases is not normal any more. For example, the infection in the gastro-intestinal tract can develop serious inflammation in the upper part of stomach with the probability of causing indigestion cannot be controlled without proper medication. Even the situation of a diarrhoea patient is very pathetic as he/she experiences stomach cramp, headache, nausea and vomiting in a continuous process. The loss of appetite due to this develops weakness within the body of concerned patient. In this type of situation, hospitalization is absolutely necessary where the doctors used to practise routine check-ups and also are instrumental to carry out some laboratory tests. During the field survey, it was observed that the CHCs are not at all equipped with specified kind of infrastructure to carry out the medication of these patients. Owing to this reason, the local people are going mostly to the nearby Jahangir Gandhi Hospital which is the medical unit of TATA Refractories Limited (TRL). Though this hospital is reserved for the employees of TRL, others are welcomed with their own cost of treatment. The following table describes the monthly expenditure on doctor's fee, medicine and laboratory tests respectively.

Table No. 7.6: Direct Medical Cost (Monthly)

Variables	Values (in days/rupees)
Pre Mining Scenario	
$A_{1:}$ Average doctor visit in a month	1.07
$A_{2:}$ Average cost of doctor's fee	Rs 35.31
Cost for sample household = C_1: $A_1 \times A_2$	37.78
B_1: Average Case of taking Medicine	1.13
B_2: Average expenditure on Medicine	Rs. 40.52
Cost for sample household = C_2: $B_1 \times B_2$	45.78
L_1: Average Laboratory Test	1.18
L_2 : Average Expenditure on Laboratory Test	Rs. 26.41
Cost for sample household = C_3: $L_1 \times L_2$	Rs. 31.16
Post Mining Scenario (Working Communities of MCL)	
$P_{1:}$ Average doctor visit in a month	3.37
$P_{2:}$ Average cost of doctor's fee	0.00
Cost for sample household = T_1: $P_1 \times P_2$	0
S_1: Average Case of taking Medicine	3.37
S_2: Average expenditure on Medicine	Rs. 78.53
Cost for sample household = T_2: $S_1 \times S_2$	Rs. 264.64
M_1: Average Laboratory Test	1.94
M_2 : Average Expenditure on Laboratory Test	0.00
Cost for sample household = T_3: $M_1 \times M_2$	0
Post Mining Scenario (Non-Working Communities of MCL)	
$R_{1:}$ Average doctor visit in a month	2.29
$R_{2:}$ Average cost of doctor's fee	Rs. 112.59
Cost for sample household = E_1: $R_1 \times R_2$	257.83
H_1: Average Case of taking Medicine	2.87
H_2: Average expenditure on Medicine	Rs. 467.01
Cost for sample household = E_2: $H_1 \times H_2$	Rs. 1340.31
K_1: Average Laboratory Test	1.63
K_2 : Average Expenditure on Laboratory Test	Rs. 94.56
Cost for sample household = E_3: $K_1 \times K_2$	Rs 154.13
Control Village	
$M_{1:}$ Average doctor visit in a month	1.04
$M_{2:}$ Average cost of doctor's fee	Rs. 54.67
Cost for sample household = G_1: $M_1 \times M_2$	56.85
D_1: Possible Case of taking Medicine	1.00
D_2: Average expenditure on Medicine	Rs. 49.86
Cost for sample household = G_2: $D_1 \times D_2$	Rs. 49.86
N_1: Average Laboratory Test	1.00
N_2 : Average Expenditure on Laboratory Test	Rs. 1.00
Cost for sample household = G_3: $N_1 \times N_2$	Rs. 1.00

Source: Field Study

The above Table (No. 7.6) clearly depicts the monthly direct medical costs of the sample households. According to the respondents of sample villages, during pre-mining phase the direct medical cost was comparatively lower than the post mining era. The average of medicine cost, doctor's fees and laboratory test were not very frequent as the residents were free from any kind of pollution measures. But the post mining situation is quite different than the pre mining phase. Not a single household in the mining affected villages is free from any type of disease and all are paying more cost towards their health hazards. Then again, there is a contrasting difference between the MCL employees and the non-working communities of MCL.

There is a striking difference in terms of health cost between them. The average wage rate of the MCL employees is higher than the non-employees and at the same time the workforce are availing all kinds of medical facilities from the central hospital of Ib valley. Even during serious health issues, the employees are entitled to do their proper medication at any specialised hospital or clinic through the recommendation of chief medical officer of MCL. So the working communities are exempted from the expenditure on doctor's fee, medicine and laboratory test. They are buying only the vitamin and calcium tablets as it is not provided by MCL drug house. Due to their working environment the continuous exposure with coal dust and machineries are compelling them to consult the doctor more than two times in a month but they are free to pay any fees for consultation.

But the non-employees of MCL are not that fortunate to avail any kind of medical facility. So their dependency on the nearby hospitals and clinics is quite high. At first they used to visit the community health centres and when failing to get rid out of their health issues they are availing the medical facilities of other private hospitals or clinics by remunerating their own cost. Because of this the average direct expenditure on health is high among the non-employees. On the other hand, the control villagers are experiencing comparatively less money in the direction of direct medical cost. The reason behind this is the unavailability of any kind of industrialised units which are the central source of pollution in this belt.

7.4.3. Indirect Cost of Health Hazards

Next to the direct medical costs, there are some indirect medical costs associated with it which includes the loss of work days due to ill health and income loss due to this. Because of ill health, the local residents are frequently visiting the doctors and getting hospitalised repeatedly. Therefore, they are losing their workdays and incomes recurrently. The following table will evaluate the indirect medical costs of illness.

Table No. 7.7: Indirect Medical Cost (Monthly)

Variables	Values (in days/rupees)
Pre Mining Scenario	
D: Total Number of work days lost in a month	187
W: Average daily wage rate	Rs 114.02
W_1: Total wage loss for sample household = W × D	Rs 21321.74
W_2: Wage loss per household = W × D /(Total sample)	Rs 71.02
Post Mining Scenario (Working Communities of MCL)	
D_2: Total Number of work days lost in a month	432
F: Average daily wage rate	Rs 511.92
W_3: Total wage loss for sample household = F × D_2	Rs 221,149.44
W_4: Wage loss per household = F × D_2 /(Total sample)	Rs 1445.42
Post Mining Scenario (Non-Working Communities of MCL)	
D_3: Total Number of work days lost in a month	421
I: Average daily wage rate	Rs 184.12
W_5: Total wage loss for sample household = I × D_3	Rs 77514.52
W_6: Wage loss per household = I × D_3/(Total Sample)	Rs 527.30
Control Village	
D_4: Total Number of work days lost in a month	83
J: Average daily wage rate	Rs 188.59
W_7: Total wage loss for sample household = J × D_4	Rs 8069.44
W_8: Wage loss per household = J × D_4/(Total Sample)	Rs 80.69

Source: Field Study

The table drawn above (No. 7.7) is giving a clear picture regarding the loss of work days in a month and income loss due to this. However, in the pre-mining phase, all the 300 households were reportedly lost 187 days in a year. But in the post mining phase, the deterioration of health condition is posing obstacle to skip the work days. But the loss of work days is higher among the MCL employees rather than the non-employees. As we have already discussed, the regular exposure with the coal particles and apparatuses are the central cause behind this. Here it is worth to mention that, the wage loss per household for working communities was calculated from the sample of 153 and the wage loss per household for non-employees of MCL was calculated from

the sample of 147. Loss of work days has direct negative impact on the loss of income due to uncontrollable health hazards. As the average wage rate of the MCL employees is more, their wage loss is comparatively high than the non-employees. Due to the dogmatic health issues they are hindering themselves from earning. Although the loss of income is associated with several socio-economic traumas, still they are feeling deserted in this regard. On the reverse side of this state of affairs, the situation of pre-mining and control villages is more or less same. In both the case, all the households are bearing the average loss of Rs. 71.02 and Rs. 80.69 respectively.

7.5.Total Cost of Health Hazards

The total cost of health hazards is the sum of all the attributes i.e. direct and indirect medical costs. So the total cost of health hazards per household is as follows:

7.5.1 Total Cost per Household (Pre Mining):

$TC_1 = C_1+C_2+C_3+W_2$

$TC_1 = 37.78+45.78+31.16+71.02$

TC_1 = Rs 185.74

7.5.2 Total Cost per Household (MCL Workers):

$TC_2 = T_1+T_2+T_3+W_4$

$TC_2 = 0+264.64+0+1445.42$

TC_2 = Rs 1710

7.5.3 Total Cost per Household (Non-employees of MCL):

$TC_3 = E_1+E_2+E_3+W_6$

$TC_3 = 257.83+1340.31+154.13+527.30$

TC_3 = Rs 2279.57

7.5.4 Total Cost per Household (Control Village):

$TC_3 = G_1+G_2+G_3+W_8$

$TC_3 = 56.85+49.86+1.00+80.69$

TC_3 = Rs 188.4

From the above assertions, it is clear that the total cost of illness is high among the non-employees of MCL. Even though, they are consuming the same kind of health effects, they are not availing any medical aid from MCL. The medical facility is restricted only to the work-force of MCL and others are remunerating their own cost. However, the average direct cost medical cost of the MCL employees is relatively less in comparison to the non-working communities. But the indirect medical cost is relatively high among the working groups as their wage rate is much higher than the non-workers. Then again, the average total medical cost of illness is high (Rs. 2279.57) among the non-employees in comparison to the employees (Rs. 1710). The variation is prevalent only because of the direct and indirect medical costs bearing by the working and non-working communities. In contrary to this, the scenario of control village is much better. Their total cost of illness is reasonably less and the pre-mining phase has also some resemblance with it, as their total cost is approximately identical.

7.6. Impact of Mining on the Health of Livestock

According to the estimation of World Bank around 1.3 billion poor populace of developing countries have direct or indirect dependency on livestock for their sustenance. Most of the rural poor used to keep livestock for their own economic support. Livestock plays multiple functions in shaping the agricultural and rural economy of the developing countries. Livestock husbandry is a unique agricultural sub-sector as it subsidies 1.5 percent towards the growth of GDP universally. Around 29 percent of world's surface land is being recycling for livestock production (World Bank, 2008).

In the present study, while conducting the field survey the mining affected villagers replied that since ages they used to keep livestock for their own benefit. As mining started acquiring the land, the grazing land has decreased to large extent. Even the release of waste particles in to the air and water environment of the surrounding region has decreased the quantity of livestock at Ib valley coalfield region. During field survey, the residents replied that they used to possess varieties of livestock such as cow, buffalo, goat, sheep and poultry birds. But the intrusion of mining activities in the adjacent region has affected the sustenance of livelihood units. Much before the

initiation of mining activities, livestock rearing was regarded as a source of livelihood but ill effect of mining has wiped out the source to a large extent.

In the pre mining phase, the rural people were instrumental to generate varieties of income earning sources. But the intrusion of mining has restricted the sources as it destroyed the natural capital entirely. With the depletion of natural capital the mining affected communities didn't put any interest to keep any type of livestock assets. Again the deterioration of environment is instrumental for the decline of livestock. The following table will describe the reason behind the decrease of livestock assets at Ib valley coalfield area.

Table No. 7.8: Health Problems of Livestock

Types of problems (Livestock)	Mining Affected Villages		Control Villages
	Pre Mining	Post Mining	
Disease	70 (23.3)	5 (15.7)	25 (25)
Weakness	217 (72.4)	2 (6.2)	73 (73)
Decline in productivity	-----	9 (28.2)	-----
Decline in quality and quantity of manure	-----	3 (9.3)	-----
Death	13 (4.3)	13 (40.6)	2 (2)
Total	300 (100)	32 (100)	100 (100)

Source: Field Study

Note: Figures in the parenthesis are percentage

The above Table (No. 7.9) is providing a clear cut scenario regarding the type of health problems the livestock are facing. It was observed that in the post mining phase out of 32 sample households majority (40.6 percent) of the households revealed that their livestock are dying after grazing the contaminated grass and drinking the polluted water. The other reason behind the unnatural death of livestock is the abandoned mining sites. As the authorities are not undertaking any kind of awareness measures to protect the abandoned mine sites, abundant of livestock are losing their lives by falling in it. Even they narrated that their livestock are suffering with various kinds of diseases and weaknesses. Deterioration of productivity and decline in the quality and quantity of manure are also the issues related to livestock. On the contrary, the situation of control villages is somehow related with the situation of pre-mining phase. Death rate of livestock in these two sections is very low. At the same time, the disease and weakness section are also sharing the equal attention. However,

the reason behind the disease and weakness of livestock at control villages is entirely seasonal. Mostly during the rainy season the livestock are exhibiting some sort of water borne diseases. The seasonal diseases are also there in the mining affected villages but the frequency is high in comparison to the pre mining and control villages.

7.6.1. Expenditure on Livestock

The monthly medical expenditure of livestock is much higher in the post mining phase. The average cost of doctor's fee and medicine are more in compare to pre mining phase. According to the residents of mining affected villages, livestock are falling ill very frequently and when developing serious health hazards they are dying inadvertently. In comparison to the post mining era, the expenditure during pre-mining phase is comparatively less in quantity. Absence of any complicated issue is also protecting the residents of control villages to procure any undesirable expenditure on livestock.

Table No. 7.9: Expenditure on Livestock (Monthly)

Variables	Values (in days/rupees)
Pre Mining Scenario	
$P_{1:}$ Average doctor visit in a month	1.02
$P_{2:}$ Average cost of doctor's fee	Rs. 31.21
Cost for sample household = C_1: $P_1 \times P_2$	Rs. 31.83
B_1: Average Case of taking Medicine	1
B_2: Average expenditure on Medicine	Rs. 33.32
Cost for sample household = C_2: $B_1 \times B_2$	Rs. 33.32
Total Expenditure TX_1: $C_1 + C_2$	Rs. 65.15
Post Mining Scenario	
$S_{1:}$ Average doctor visit in a month	2.26
$S_{2:}$ Average cost of doctor's fee	Rs. 102.39
Cost for sample household = H_1: $S_1 \times S_2$	Rs. 231.4
M_1: Possible Case of taking Medicine	2.37
M_2: Average expenditure on Medicine	Rs. 261.01
Cost for sample household = H_2: $H_1 \times H_2$	Rs. 618.59
Total Expenditure TX_2: $H_1 + H_2$	Rs. 849.99
Control Village Scenario	
$K_{1:}$ Average doctor visit in a month	1.04
$K_{2:}$ Average cost of doctor's fee	Rs. 50.37
Cost for sample household = N_1: $K_1 \times K_2$	Rs. 52.38
O_1: Possible Case of taking Medicine	1.00

O_2: Average expenditure on Medicine	Rs. 46.36
Cost for sample household = N_2: $O_1 \times O_2$	Rs. 46.36
Total Cost TX_3: $N_1 + N_2$	Rs. 98.74

Source: Field Study

The table drawn above (No. 7.10) is clearly describing the household expenditure on livestock. The total expenditure of mining affected households is very high, as their live stocks are suffering from varieties of air and water borne diseases. Generally the contaminated water is responsible for the occurrence of wide-ranging ailments. But the control village situation is entirely different from post mining situation. Their average expenditure on livestock is Rs. 98.74 which is quite similar with the pre mining phase, when the residents used to spend an average of Rs. 65.15.

7.7. Conclusion

With respect to pre mining period, the post-mining phase has witnessed varied acute and chronic health hazards. Prior to mining, the villagers were having normal health issues such as headache, body pain, seasonal diarrhoea, seasonal fever etc. But the post mining phase has given a contradictory picture on health fronts. In addition to the variation to the frequency of falling ill, the occurrence of health hazards are quite permanent. The frequently occurring diseases i.e. TB, malaria, diarrhoea, eye-allergy, skin-disease etc. are causing hindrance to skip the work days and as a result income loss is achieving its space. In this regard the total cost of illness was calculated and as per the result, the total cost of illness is more among the non-employees of MCL rather than the employees. Even the variation is much high in comparison to the pre mining as well as control villages. Pollution is not only responsible for the deterioration of human health, but at the same time, it has sheer negative impacts on the local live-stocks too. However, the central cause behind the inimical health conditions are the continuous deterioration of air and water quality. Then again, the noise that is coming out at the time of blasting, drilling and transportation is adding another reason for hazardous health. Despite physical health, the mental health is also deteriorating as mining leading to displacement, breakdown of network ties, annulment of kin members etc. The unavailability of safe and secure sources of livelihood is compelling the villagers to work in the precarious environment of mining and they are sustaining varied health complications. So it is the responsibility of MCL

authorities to protect the community from possible health impacts. To consider itself environment friendly, it necessitates the minimization of air and water pollution, decrease of noise and vibration and compensatory afforestation in the active mining zones. Besides this, the MCL authorities should make some provision for the non-working communities of affected villages to avail appropriate medical facilities.

Chapter-VIII
Summary and Conclusions

Natural resources epitomize the prosperity of a country. It is available in abundance and affords adequate atmosphere for economic development. Coal is regarded as one of the most significant non-renewable natural resources. The expansion of coal mining operation has generated employment opportunities, establishment of new infrastructures, and initiated crusade against poverty. But the rapid mining activities have however narrowed down the utility and benefits of natural resources. Pertaining literatures reflect that the exploitation of coal through opencast and underground mines is responsible for various socio-economic and environmental problems such as pollution of air, water and noise, disease and sickness, besides other problems such as decline in agricultural productivity, deforestation, displacement etc.

Over the years, stakeholders of such industry have been endeavouring to avoid and mitigate the probable adverse effects of mining on local communities. Both the State and the Central Governments are increasingly formulating and adopting policies to minimize the socio-economic adversities of mining. The mining companies themselves are struggling to grapple with environmental hazards. However, the expertise and policies have not been able to bring appropriate solutions. With this background, the present study tried to analyse the impact of coal mining on local communities and their livelihood in Ib valley coalfield of Odisha. It also explored the impact of coal mining on rural social structure and their health.

8.1. Methodology

To attain the above said objectives, the study was conducted in Ib valley coalfield of Jharsuguda district in the Mahanadi Coalfield Limited region of Odisha. As part of the study, six mining affected villages and two control villages were selected. While mining affected villages were selected within the vicinity of three kilometres from mining, control villages were selected around twenty kilometres distance from the active mining region. However, both the mining affected and control villages are in the same agro-climatic zone and in the same district. Using the systematic random sampling method, a sample of 50 households from each village was undertaken. Thus a total of 400 such households (300 from mining affected villages and 100 from

control villages) were taken as sample for the study. Data were collected by employing both qualitative and quantitative techniques. The primary data were collected using household schedule, case study, observation methods and some unstructured questionnaires. Discussions were organized with public and other stakeholders. In depth interview was also held with officials from the Mahanadi Coalfields Limited, State Government, NGO personnel, and local leaders. For secondary information, government records, newspaper articles and other available literatures were reviewed. Then the data were analysed by using SPSS and other statistical methods.

To support the central argument of the thesis, a theoretical framework was developed. In this connection, few theories i.e. (1) social solidarity (2) strength of weak ties (3) alienation (4) Ruthenberg's rotation (R) value and the theoretical framework given by DFID were used. Besides these theories, cost of illness method was also approached to analyse the impact of mining on health.

8.2. Overall Findings

8.2.1. Impact on Rural Social Structure

While examining the impact of mining on rural social structure, due emphasis was given on structure and function of family, marriage pattern, kinship ties, inter caste relation, power-relation, celebrations of fairs and festivals, community life, social security, etc.

8.2.1.1 Structure of the Family:

Accordingly the first impact of mining was perceived in the structure and function of family. However, it was observed that, in the mining affected villages the structure of family system remains mostly nuclear. As per the Resettlement and Rehabilitation Policy of MCL, it is providing physical compensation in terms of employment to the elder son of each entitled family. When the elder one gets such benefit, he is more inclined to establish his separate household than remaining attached to his joint family. On the contrary, other vulnerable members of the family are deprived of employment, and are forced to whether migrate or live separately. During the field investigation in the mining affected region, it was observed that most of the household members are inclined to form their independent household within the same hearth.

However, the rise of self-centred attitude and individualism are the factors behind the conflict regarding the partition of ancestral property. In some cases, it was observed that though they live under one roof, they maintain a very formal relation with each other. In few cases, it was also observed that the old parents are neglected by their children who got job on the compensatory ground. Even the complaint submitted to MCL by old parents did not bring any gain for them. Consequently, they are left in their poor condition, and are spending their lives mercifully. In this dejected condition, they either sell coal or offer to work as labourer for their survival. The old aged villagers who were once pleased and satisfied with the happy life they had before are now cursing MCL for their present predicament.

It was observed that in the mining affected villages nearly 78.3 percent households are having nuclear family system, followed by 20 percent joint family and 1.7 percent extended family system. But prior to mining, the situation was different. Earlier, 74 percent households lived in joint family system and 24.7 percent in extended family. The concept of nuclear family was very strange and limited and therefore it was restricted only to a meagre 1.3 percent. Here, it can be mentioned that prior to mining the society was entirely agrarian and human mobility too was very restricted. But mining has introduced individualism and self-centred attitudes rather than humanistic ones. Compared to his, the percentage (56 percent) of joint family system is relatively more in the control villages that were visited for the study purpose. Next to joint family, there comes nuclear family (32 percent) followed by 12 percent extended family system. Moreover, the control villages are situated within closure proximity of nature and their primary source of occupation is agriculture. As a result all the kin members are taking active participation in the family events which preserves the family structure secure. This depicts a clear picture of unity, equilibrium and social cohesion.

8.2.1.2. Functions of Family:

As a chain reaction, this change in the family structure also influences the functional aspects of family. In the words of Francis Abraham, there are six functional aspects of family i.e. procreation, sexual regulation, economic support, social placement, socialization, and emotional security. All these functional aspects are undergoing remarkable changes in post mining period. For example, the busy schedule of the

parents, absence of senior household members, increased cost of living and development of self-centric attitude are responsible for the changes in the functions of family. Similarly, prior to mining, family was considered as the production as well as consumption unit. All the members of a family were directly connected with agriculture and cultivation to meet the financial requisites of their family. In the contemporary era, mining has grabbed almost all the agricultural and forest lands. While there is no land left for agriculture and other allied activities, the family as a unit of economic support is losing its importance.

8.2.1.3. Marriage:

Next to family, marriage is considered as a basic social institution which helps in the continuation and running of the institution of family. In the present study it was observed that structural aspects of marriage do get modified a lot, though the functional aspect is almost the same. Prior to mining the primary aspect of marriage was the attainment of religious sacrament (66.7 percent) followed by social bond (27.7 percent) and socio-economic security (5.7 percent). But this idea is changed in the post mining era. The study reflects that in the post mining phase, mining affected people are more materialistic than religious. As per the responses collected, it was found that they give utmost importance to social and economic security (48.3 percent) rather than religiosity of marriage (5.3 percent). The reasons behind this are the cost of living and unavailability of any permanent source of livelihood. As mining spread up, outsiders entered into this locality in search of jobs. This has widened the scope for cultural tensions. As a result there are significant changes in the ritualistic practice of marriage. Among the mining affected villagers, marriage by choice is a popular concept rather than marriage by arrangement. The concepts of caste endogamy is getting dismantledand clan exogamy is losing its importance. But in the control villages, all these attributes have their own way of practice.

8.2.1.4. Caste System:

The rural society used to exhibit authoritative control on traditional caste system as well as power structure. Basically, caste system has its rigid rules and implications in the selection of occupation. During the pre-mining phase, the role of different castes was well defined. Every caste group had their pre-determined occupational rules and ethics which they strictly followed. However, with the introduction of mining,

agriculture has lost its relevance. As agriculture lost its importance, the caste system which is woven around social structure lost its relevance. Right to choose one's occupation is a popular and practical philosophy now. However, the social inequality in caste system is still in practice among the residents of both mining affected and control villages. But the existence of social stigma in mining affected villages is very minimal and restricted to some specific households.

8.2.1.5. Mining and Power Structure:

Power is an important aspect without which it is difficult to define Indian social structure. It embraces influential mechanism to regulate the fellow members of a definite society. Much before the introduction of mining industry, in the mining affected villages, the Brahmins and OBCs used to exercise authoritative power because of their land holding status. The other sections of the villages used to depend on them for their livelihood. They used to take all the decisions of their respective villages. As the mining has taken away all these lands, the land based power relation has lost its significance. Most of the land holding higher caste households who received good compensations either left the village and settled somewhere on their own or joined prestigious positions at MCL because of their closure proximity with officials and higher level political leaders.

8.2.1.6. Mining and the Rise of Contractor Class:

Some of these landholding houses who lost their land due to mining have emerged in a new class form called contractor class. Because of their economic and political status these contractors are having proximity with MCL authorities. It was observed that a large number of landless and marginalised villagers are seen running behind the contractors for getting non- agricultural occupation. The contractors were also seen as vote banks as they have large number of people under their control. Villagers report that at the time of different Panchayat and general elections the contractor class people are seen wooed by different political parties as they have numerical strength in the villages and also having political connections outside of the villages.

In the mining affected villages a small cluster of considerably educated leaders were allegedly involved in the 'right to procure' movement. The marginalised people have deep faith in these leaders. But these so called front-runners are not trustworthy at all.

Most of the time, it has been observed that these so called leaders are getting cosy with the MCL authorities for their personal benefits and as a result the marginalised sections are becoming clowns in the hands of both MCL authorities and their own leaders. So here the MCL authorities are procuring the authoritative power over the village dwellers in a quite bewildering approach. In contrary to this scenario, the traditional power structure of control villages is still controlled by the upper caste population. The landowning upper caste populace are holding the authoritative power in the villages.

8.2.1.7. Mining and *Jajmani* Transformations:

The rural economy of India was purely caste based. The inter-caste relationship that is *Jajmani* relationship helped in fulfilling the economic requirement of the villagers. The present study witnessed that, there occurred significant modifications in all the three forms of *Jajmani* relationship at Ib valley. They are: (1) change in Landlord-*Purohit* Relationships, (2) change in Landlord-Service *Jati* Relationships and (3) change in Landlord-Agricultural Labour Relationships.

Modifications in the context of landlord-*purohit* were found significantly. It was observed that the traditional *purohit* are not at all practising their caste based occupation. Rather they are the rich occupants of their respective villages. Whenever, there is the need of any *purohit*, the villagers invite *purohit* from other villages or nearby temples to perform the ritual. Changes also occurred in the context of landlord-service *jati* relations. Previously, society was revolving around two types of groups i.e. landlord (patron) and service providing *jati* (servant). The servants belong to the lower caste groups such as blacksmith (*Kamara*), Washerman (*Dhoba*), and Carpenter (*Badhei*) . All these servant groups used to provide service to their patrons and in return they were rewarded with gift, cash or kind. But in the post mining phase, traditional occupation is hardly in practice and it takes a great deal of persuasion to seek their service during any ceremonial activities. As mining is providing them a type of fix remuneration and also on a permanent basis, they become more money-minded also.

Similar changes were observed in the landlord-agricultural labourer relations. Prior to the introduction of mining, society was agro-based and there were landlords followed by agricultural labourers. The agricultural labourers were providing their service by

working in the agricultural fields of their landlords. The relationship between the landlords and agricultural labourers was secular rather than ritual. They treasure a kind of patronage relationship among them. Besides wage, the landlord used to provide benevolent assistances such as free food, clothes and additional prerequisites at the time of need to the agricultural labourer. Presently, mining has grabbed most of the agricultural lands and only 32 households are cultivating few agricultural land. As the land was the central point on which the entire *jajamani* relation was built up, it has become futile to continue this relationship when the lands are taken by mining companies. Now all most all service caste households and agricultural labourers have left the traditional occupation and joined in mining activities directly and indirectly. The secularistic service of the *jajamani* relation is completely disappeared and only the ritual aspect is present in case of few households. Here payment is made not in the form of kind or grain but in the form of cash. This situation is seemingly different in the control villages. Here the households are not practising it entirely, still the landlord-*purohi t*relation and landlord-service *jati* relation are in practice is a skeletal form.

8.2.1.8. Mining and Fairs and Festivals:

Mining has tremendous negative impact on village fairs and festivals. Observations of fairs and festivals sustain cultural heritage. They accomplish a benevolent uniqueness and gratitude of a specified civilization. During field study, it was observed that the residents of Ib valley usually celebrate two types of festivals i.e. community level festivals and household level festivals. Among the community level festivals they observe *Nuakhai, Pausha Purnima, Gokulastami Jatra, Rasa Purnima, Naam Jangya* and *Ranjta* Festival. All these festivities have their own historical and mythological importance. But the interference of mining has disturbed the usual practise of these festivals. As mining has taken away all most all the agricultural land, the festivals relating to agriculture are totally stopped. Only the *Nuakhai* festival which is purely an agro-based festival is still observed by the villagers. Residents buy paddy either from market or from other non-mining villages to perform the rituals. The core philosophy that the farmer offers its first product to God to appease the God and Goddess is no more. As this festival is considered as big festival of western Odisha and represent the identity of western Odisha people, they now observe it for the sake of observance. While the non-agro based household level festivals are continuing, the

community based festivals are highly affected in post mining period. As mining is forcing the villagers for involuntary displacement, they are losing the sense of co-ordination and unity to observe these. Even though some of the rituals and festivals are in practice, the mode of celebration changed in post-mining era. Here it can be concluded that, with the disbursement of community cohesion, residents of Ib valley are becoming self-oriented.

8.2.1.9. Mining and Community Life:

The strong bond of interaction and interrelationship describes the unique pattern of community life as well as social security. The presence of social solidarity defines this distinctive attribute in a more cohesive way. But the issues such as hierarchical arrangement of caste system and unequal distribution of power are the interruptions that were found in the mining affected villages. Even in the post-mining era, the upper caste residents are exercising the governing powers. But this situation is not same everywhere. Except, Khairkuni, Ubuda and Kudopali villages, all other villages hold the representation of SC and ST households. Remarkable change was also perceived in the leisure time work of the villagers. Previously, they used to spend their leisure time to discuss and work for the developmental aspect of their respective villages. But at present they tend to spend their leisure time by doing their own household work and at times they watch TV. Even the competition to lead a better life is resulting in varieties of socially restricted promiscuities such as black marketing, juvenile delinquents, child labour and prostitution. But, on the other hand, the control village situation is entirely different than the mining affected villages. Among them the society of likeness is dominating over the society of differences

So it can be concluded that, by representing the cohesiveness and communal integrity, the society of pre-mining and control village denotes all the characteristic feature of mechanical solidarity. But, the emergence of individualistic and self-centred attitudes in the post-mining scenario denotes organic solidarity among the mining affected communities. Hence the theory of social solidarity has its own justification while analysing the social structure of Ib valley.

While analysing the type of social network, Granovettor's theory of "Strength of Weak Ties" was also approached. The change in structure and function of family, the intrapersonal kinship relation, the transformed *Jajmani* system and power relation,

non-observance of rituals and festivals and discontinuity of community relation are the factors affecting the network ties between the mining affected communities. As a result, a kind of weak tie exists among the mining affected households. This theory describes that change in one aspect affects the other aspects too. In this regard, when the society members are weakly tied with each other, their network is weak too.

8.3. Impact on Livelihood

Livelihood itself is a broader concept to study. Therefore, in the present research, the sustainable livelihood (SL) framework of DFID was adopted to define and analyse the diverse impacts of mining on rural livelihoods. While, employing the SL framework, the present research started unfolding the vulnerable context of livelihood i.e. mining. It was observed that, prior to mining society was restricted only to agro-based and common property based income earning sources. But with the intrusion of mining activities, broader and varied aspects were come into existence. However, to draw a detailed analysis regarding the impact (positive/negative) of mining, the five core assets were explained.

Mining has sheer negative impact on human capital. Basically, human capital deals with the skills, knowledge and good health to cultivate different livelihood strategies. But in the present study, MCL is not providing any health care facility to all the mining affected communities in Ib valley. However, the medical assistance is available only for the working communities of MCL. Similarly, not a single initiation takes place to improve the educational qualification as well as any formal training to improve the skill and knowledge of the mining affected people. In post mining period most of the villagers have become business oriented rather developing their career by pursuing any educational degree. Getting a job in MCL is just a safe haven for them. Some of them have developed a tendency to go for ITI and Diploma course in order to get a job in MCL.

Mining has a kind of mixed impact on physical capital. In the present research, physical capital was divided into two parts i.e. (a) impact on community level physical capital and (b) impact on household level physical capital. While analysing the impact on community level physical capital, it was observed that up to 31st March 2014, MCL occupied 6491.868 hectares of tenancy land, 4448.314 hectares of govt.

land and 2924.1 hectares of forest land in IB valley. It reflects a massive loss to the community level physical capital.

Besides land, infrastructural development plays an important role in the context of human capital. Under the CSR activity of MCL, separate connected roads including haul roads were made. But due to improper maintenance, these roads turned them as accident prone roads. Among other infrastructures, transportation, supply of electricity and supply of drinking water supply are the significant ones. But severe in-discrepancy was found for the supply of drinking water. According to the villagers, MCL's water supply is not regular at all. While agreeing with the fact of MCL's drinking water supply, residents replied that water tanker comes twice or thrice a week which causes serious issues mostly during summer season. The infrastructural development done in study areas mostly come under CSR activities. Hence, the scenario of Ib valley implies that only in those villages where the public representatives were dynamic and had a kind of political lobby were successful in bringing projects under CSR, they got benefited.

In the context of household level, physical assets, mining has positive impact on it. As mining is providing permanent and improved income sources, the residents are well versed with the assets such as motor cycle, television sets, mobile phones, cooler, dish antenna, pucca and semi-pucca houses etc. As agriculture is not in practice, the assets like bullock cart, pump-set, plough and craft cutter are less in number. A significant shift was found in the aspect of housing pattern. Prior to mining, majority (43.3 percent) of the households were living in the kutcha houses and only the economically well-off communities had their pucca and semi-pucca houses. Even the underprivileged sections were having huts and temporary houses. But in the post mining era a shift was marked in this aspect. In the mining affected villages, majority of the respondents are having their own pucca (37.7 percent) and semi pucca (40.3 percent) houses. But the situation of control village has some resemblance with the pre mining period. Here, majority (52 percent) of the respondents are staying in the kuctha houses and only 8 percent households have pucca houses. The disparity was found because of improved financial condition.

In spite of lots of social cost, mining has brought an economic gain for the villagers. Its introduction has brought positive impact on financial capital. During pre-mining

period the households' average annual income was Rs. 41,046.00, but it has gone up to Rs. 17333.33 for working communities of MCL and Rs. 66,281.63 for non-working communities now days. Similarly, the average household income of control village is Rs. 58,734.90 per annum. The income variation in the pre mining, post mining and control villages was found because of the nature and type of occupation. In the pre-mining phase, society was agro-based and the occupation was seasonal in nature. But in the post mining era, society is dominated by mining related activities. As majority of the residents of control villages are still practising seasonal agriculture like pre-mining period, they are having low annual income.

Prior to the introduction of mining projects the entire occupational scenario of the affected villages was agro-based. The forest resources were also another major source of income for them. However, with the introduction of mining agriculture, which was a major source of livelihood, is mostly replaced by non-farm activities. The loss of biodiversity due to pollution and mining activities has disturbed the livelihood pattern of mining affected villagers. Even the source of incomes has become more or less mining centric in the post mining period. While the diversified source of income has lost its importance in post mining period, the assured source of income from mining sector has increased the purchasing and investing capacity of the villagers. There are various forms of business nurtures in the mining villages. While some have rented out their tractors and vans, some run hotels, pan shops, grocery shops and cycle repair shops, and some are engaged in the vegetable business. Some households in the mining villages have indulged in income-generating activities such as drivers, helpers in tractors, tailors, blacksmiths, barbers, contractors, etc.

Mining has witnessed potential negative impact on natural. Because of mining, the natural environment is degrading day by day. Emission of coal dust and waste particles during transportation, loading, unloading, blasting, etc. is making life impossible. Even the usual temperature in summer touches nearly 50^0. Water bodies such as ponds, tube-wells and open wells are getting polluted very frequently. The continuous release of waste water into the nearby *Lilari Nallah* and Ib river is not only responsible for the pollution of water bodies, rather it is the central reason behind the prevalence of varieties of water and air borne diseases. Likewise, the natural vegetation is decaying frequently. The households who had their primary income from the natural resources like fishing, haunting, and collection MFPs have lost their

livelihood. Even the loss of grazing land is compelling them not to possess any livestock.

Mining bears a negative impact on social capital. In the present research, the network connectivity was absolutely disturbed among the mining affected communities. Expansion of mining wings has displaced thousands of household and at the same time it has dismantled the network ties of the project affected people. Again, displacement is not only creates fragmentation but it also indulges in family disputes.In search of employment opportunity clusters of migrants are coming to the mining regions and during their stay, the amalgamation of cultural identity is taking place which in turn disturbs the actual ethnic identity of the region.

8.4. Impact on Agriculture

Agriculture was the central source of sustenance for the rural people of Ibvalley. But the primary cause behind the non-practise and weakening of agriculture is the emergence of coal mining industries. The other associated reasons behind the depletion of agricultural practices are: scarcity of water and agricultural labourer, use of more inputs, loss of production, pollution etc. Out of 300 sample households, only 32 households (10.6 percent) practise agriculture. Of them, 5 percent households cultivate on their own land and other 5.6 percent households practise the already acquired agro-land of MCL. But in contrast, during pre-mining phase 61 percent households cultivated on their own agricultural land and 4.3 percent households cultivated on the leased-in lands. In the control villages, out of 70 households, majority of the households (46 percent) cultivate on their own agricultural lands and rest 24 percent households cultivate on the leased-in lands of others.

During field study, it came into notice that in the mining affected villages, 17 out of 32 households follow a fallow period of one year to regenerate the soil fertility. In this regard the R value of Ruthenberg was calculated. According to Ruthenberg, if the R value is less than 66, it implies that the localities are relying on the natural capacity for the regeneration of soil. The R value for the present study is 50 and it implies that the residents have inordinate trust regarding the natural skill to prepare the productive land.

The mining has disturbed the age old agricultural activities of the villagers. Spread of dust on plants, contamination of water sources due to uncovered transportation of coal, pollution of water bodies and degradation of agricultural lands, the productivity capacity of existing agricultural land has decreased. While during pre-mining period the average production of paddy per acre of land was 12. 09 quintal it is now 6.88 quintal. The average production in control villages is more or less similar to the pre-mining age (11.54 quintal). Though the agricultural inputs such as seeds, fertilizer, and pesticides were used more in quantity in the mining affected villages, the production is comparatively less than the control and pre mining villages. So it depicts that, the input of affected unit is consuming more attention but the output ratio is declining its courtesy. In this regard, the shift of output unit was analysed. As per the result, the mining affected households incur the loss in a substantial manner. So to prove the point, the production loss aspect was given prior importance. In the present study it was calculated that the loss of production in the mining affected villages is 4660 rupees per acre.

8.5. Impact on Health

To analyse the impact of coal mining on rural health three major aspects such as reasons behind diseases, frequencies of diseases and the cost of illness were explored. Then the result was compared with the pre-mining period and also with the current situation of control villages. Based on some secondary literatures of this region, peoples' perception and researchers' observation, the reasons for health problems were inferred. Due to continuous mining activities coal related waste and coal sludge are often injected in the nearby water bodies which makes water unfit for domestic use. Even sometimes it has polluted the ground water levels. As the villagers do not have much water resources, they have no option but to use. Mining pollutants is the sole reason for the occurrence of fatal diseases. Women have direct contact with water sources for performing household's activities such as washing clothes, bathing children and collecting water which has resulted in marked irritation in the skin, respiratory tract, nasal ulcers, pneumonia etc. Mining related activities have resulted in the emission of loud noise which has disrupted the lives of those in the surrounding communities and has reduced the quality of life.

Dispossession due to mining has brought a great loss in the quality of life of the traditional households. In the pre mining period when the villagers had full access to forest, agriculture their health and nutrition were better off as compared to the present scenario. The diversity of crops which were grown by the villagers earlier as well as the forest products such as roots, fruits, and traditional herbs provided balanced nutrition to the villagers but in the contemporary era, access to forests, nutrition and fruits has been blocked completely.

Villagers who are living in the vicinity of coal mines are the worst affected. Direct Inhalation of air pollutants has given rise to asthma attacks, respiratory infection and changes in lung function. As per the hospital and household survey data, TB, malaria, asthma and skin diseases are the prevalent diseases frequented in this belt. It was mentioned by the residents that the frequency of diseases suffered by the villagers have increased in manifold. Diseases such as tuberculosis, cough and cold, malaria, skin diseases, diarrhoea, joints pain, arthritis, gastro-intestinal infection, eye-allergy and high BP are among the common diseases.

Health policy of MCL is not robust as it does not look upon the plight of a non-employee. Non-employees of the Mahanadi Coalfield Limited in particular do not have free access to medicine but are equally affected. Much initiation are not being taken from mining companies to provide better health services to all the villagers in mining affected villages. Though it organizes health camps, it is not regular and village specific.

The introduction of mining has not only increased the frequencies of diseases in mining affected areas but also increased the cost of health and illness. Irrespectiveof working and non-working communities all are affected. However, working communities working in mining are more affected than non-working communities in mining. While calculating the cost of health hazards all the direct and indirect medical, direct non-medical costs were taken into consideration. It was found that, in the mining affected households, the average direct medical cost such as doctor's fee, medicines and laboratory tests is higher among the non-working communities than the working communities of MCL. But the indirect medical cost such as loss of work days and income loss due to this is more among the working communities. The reason behind this disparity is because of the provision of medical assistance for MCL

employees. Similarly, the direct and indirect medical cost of the control village and pre mining households were also calculated to draw the difference between pre mining, post mining and control villages. While summing up it was found that, in the pre mining phase the average cost of health hazards per household was 185.79 rupees. But in the post mining phase significant difference was found among the working and non-working communities. While the average medical cost of the working communities is 1710 rupees per month, the non-working communities are bearing an average of 2279.57 rupees per month. But due to the absence of any industrial activity and pollutant measure, the control village households are spending an average of 264.23 rupees in a month.

8.6. Conclusion

From the above findings it can be concluded that the introduction and intrusion of coal mining has provided the environment for economic gain of the villagers. At the same time it has amplified the diversified employment as well as business opportunity in comparison to the control villages. But the shadow of development brought numerous other socio-economic, environmental and health issues in its wing. To be more specific, it brought absolute negative impact agriculture, social structure, health and livelihood aspect of the residents of Ib valley.

Sustainable Livelihood Framework of DFID hypothesizes a positive livelihood outcome for rural people of Ib valley. But the present study concludes that, the SL framework has brought significant consequences with regard to natural and social capital; has given rise to positive implications on financial capital and can be held responsible for mixed impacts on human and physical capital. In one aspect, it is providing wider atmosphere for diversified sources of livelihood generation, on the other aspect it alienated the project affected rural people from their traditional agro-based livelihoods.

With the introduction of mining projects, the network tie among the mining affected population is getting disturbed and they are developing intra-personal relationship among them. While the functional aspect of each institution persists in a skeletal form, the traditional base of structural aspect has lost its significance.

While mining has provided the scope for financial up-liftmen of the mining affected communities, at the same time, it is held responsible for varied health issues. Along with improved infrastructure, it has ironically created conducive condition for pollution air, water and noise. Though the provision of medical assistance is available, it is only restricted to the workforce of MCL and others are not fortunate enough to avail any kind of benefit.

8.7. Recommendations

In the era of globalization, sustainable development requires an appropriate balance between social, economic and environmental well-being, both for current situation and also for the future. But the inadequate utilization of non-renewable natural resources such as coal can raise serious concerns for future. Coal is considered as the most important source of energy across the globe. But the mining industry such as MCL is continuously busy destroying this mineral resource bringing endless negative impacts for society. However, appropriate mitigating measures need to develop both by government bodies and MCL for the planning, execution and utilization of this inexpensive natural resource. Again, it should be done in such a way that it would not compromise the need of future generation. Hence, on the basis of findings some recommendations are developed which could be regarded as useful while implementing and developing the mitigating measures.

- The coal loaded vehicles should be properly covered at the time of transportation.
- Alternative source for waste water disposal should be focused.
- Appropriate medical assistance could be done for the non-employees of MCL.
- Deforestation can be replaced by doing reforestation in the same geographical area instead of nearby district.
- Appropriate coping strategy should be developed for the immediate rehabilitation of project affected people.
- Provision for equal distribution of R&R facility among the household members should be made to avoid unnecessary disturbances within the family.

- ❖ Provisions should be made to give much emphasis on rehabilitation rather resettlement.
- ❖ Early distribution of compensation should be made possible to avoid people oriented agitation.
- ❖ Instead of any arbitrator, resolution of conflict should be carried out directly by the involvement of both authorities and mining affected communities.
- ❖ Appropriate measures should be incorporated regarding the acquisition of leased in land and suitable compensation should be provided to the tenants.
- ❖ Employment opportunity for landless people should be generated to minimize the evil effects such as black marketing, prostitution, juvenile delinquency etc.
- ❖ Provision should be made against human trafficking and workplace harassment in the unorganised sector of mining.
- ❖ Significant actions should be made to materialise all kinds of CSR activities as well as provision should be made for the reclamation and reuse of mined-over lands.

8.8. Implication of the Study

There is very limited research done on the coal mining aspect of Odisha. Whoever has done, that is mostly from pollution and economic perspectives. It is very rare to see the study done from sociological and anthropological perspectives of mining. So the study on the impact of mining on social structure, agricultural productivity, health and livelihood will be a value addition to the field of social science and policy making sector of India in general and Odisha in particular. Findings of the study would be used to draw strategies to enhance the coping capacity with regard to the impacts of coal mining on the socio-economic lives of the people, who are living in the vicinity. Corrective strategies would help to minimise the different faces of pollution and it would also help to reduce the cost of illness. This kind of study can provide the scope for government and MCL to generate and implement alternative sources of livelihood generation. Though change in one aspect affects the other aspects, so transformation in the macro level aspects is also affecting the micro-level phenomena of rural society. For example, displacement, land acquisition and unequal distribution of

Resettlement and Rehabilitation (R&R) facilities are the major causes behind the disbursement of rural social structure. This could be saved by implementing proper R & R measures. But for the execution of these actions, there is a need of proper leadership, voluntary participation of non-governmental organisations and strong network ties among the project affected population. The research on this topic will be useful to policy makers, academicians, administrators, planners etc. in different phases for the implementation of policy.

8.9. Scope for Future Research

The findings of this research do not provide any generalised outcomes, but it can be adopted by the researchers to avail a detail idea regarding the issue of livelihood, social structure, agriculture and health at Ib valley coalfield. In the present study, the research was confined to three broad objectives. But it would be more fruitful if any research took environment and biodiversity aspects into account. Even the political and policy making aspect could be brought together to analyse the impact as well as the lacuna behind it. Besides this, a comparative study between the old and new mining regions of Ib valley would be a value addition to this field of research.

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Appendix

NATIONAL INSTITUTE OF TECHNOLOGY
Rourkela, Odisha – 769008
INTERVIEW SCHEDULE

SOCIO-ECONOMIC IMPACT OF MINING ON RURAL COMMUNITIES: A CASE STUDY OF THE IB VALLEY COALFIELD IN ODISHA

Name of the Village…….. **Date…….**

Questionnaire No…….. **House No……**

Distance from Mining……..

Section 1: General Information

1.1 Name of the block:
1.2 Name of the district:
1.3 Name of the head of the household:
1.4 Name of the respondent:
1.5 Religion: 1- Hindu [ ] 2- Muslim [ ] 3- Christian [ ] 4- Others(specify):-
1.6 Caste: 1- General [ ] 2- OBC [ ] 3- SC [ ] 4- ST [ ] 5- Others(specify):-
1.7 Name of Sub caste/Tribe:

Section 2: Demographic Details

Sl. No	Name	Relationship with HH	Sex (M/F)	Age	Education	Marital Status	Occupation		Income
							Primary	Subsidiary	
1.									
2.									
3.									
4.									
5.									
6.									
7.									

Codes used:

Relationship with HoH (Column 3): *Self-HoHH-1/Spouse-2/Father-3/Mother-4/Father-in-law-5/Mother-in-law-6/Uncle-7/Aunt-8/Brother/Brother-in-law-9/Sister/Sister-in-law-10/Son/Son-in-law-11/Daughter/Daughter-in-law-12/Nephew-13/Niece-14/Owngrandchildren-15/Sibling's grandchildren-16/Cousin (brother)-17/Cousin (sister)-18/Live-in domestic help-19/Others (specify)-20*

Educational Qualification (Column 6): *Illiterate (1); Literate (2); Primary (3); Middle (4); Matriculate (5); Intermediate (6); Graduate and above (7); Professional qualification (Specify)(8); other (Specify)(9)*

Marital Status (Column 7)*Married (1), Unmarried (2), Divorcee (3), Widow/Widower (4), Separated/Deserted (5)*

Occupation (Column 8 & 9): *Cultivation-1/Dairy-2/Fishery-3/Goatery & other animal rearing-4//Daily Wages-Agricultural Labourer-5/Skilled Wage Labourer-6/Semi or Unskilled Wage Labourer-7/Service-Private Sector-8/Service-Government-9/Trade/Business-from fixed premises-10/Owner of*

SSI/Cottage Industry-11/Other Self-employed-12/Professionals-13/Household Industry-14/Artisan-15/Vendor(Cycle/Pheri wala)-16/Others (Specify)-17.

Section 3: Sources of Family Income

Sources of work	**Number of family members engaged**		**Nature of work**				**Monthly income in Rupees**	
			Continuous/ Seasonal		**Duration of work (From - To)**			
	Pre-Mining	Post-Mining	Pre-Mining	Post-Mining	Pre-Mining	Post-Mining	Pre-Mining	Post-Mining
Agriculture								
Horticulture								
Wage labour								
Employment (Govt.)								
Employment (Pvt.)								
Common Property Resources								
Business								
Dairy								
Fishery								
Goat rearing								
Sheep rearing								
Chicken/duck								
House rent								
Rents from other property/assets								
Mine worker								
Others (Specify)								
Total								

Section 4: Mining, Displacement and Livelihood

4.1 Is there any mining activity operating near your periphery? 1. Yes [ ] 2. No [ ]

4.2 If yes, what type of mining are they?

a. Underground [ ] b. Opencast [ ] c. Dredging [ ] d. Any other (specify)……..

4.3 Name of the mining company operating there

4.4 Could you please recollect the year when mining started near your vicinity? Year [ ]

4.5 Did the mining authorities consulted with anybody in your region before mining?

1. Yes [ ] 2. No [ ]

4.6 Did anybody protested against it? 1. Yes [ ] 2. No [ ]

4.7 If yes what was the result out of that?

……

……

4.8 If no why?

.....

.....

4.9 What did you lost because of mining?

4.10 Ownership of Assets

Particulars	**Before** (Yes,1; No,2)	**Number**	**After** (Yes,1; No,2)	**Number**
Cycle				
Motor cycle/scooter				
Chair				
Table				
Tractor				
Pump sets-diesel/electric				
Plough				
Bullock cart				
Craft cutter				
Fridge				
Radio				
TV				
Music System				
Others				

Section: 5 Mining and Compensation

5.1. Year of land acquisition.....

5.2. Year of compensation.....

5.3. Nature and type of compensation

Category	**Type**	**Tick All that Apply**
Compensation received if any	Yes	
	No	
Awareness regarding Compensation	Yes	
	No	

5.3. Nature and Type of Compensation

Nature and type	**Groups**	**Tick All that Apply**
Nature of Compensation	a. Job	
	b. Monitary	
	c. Physical	
	d. All	
	e. Others(specify)	
Type of Compensation	a. Job in the proposed project	
	b. Job in other associated units	
	c. Arrangement of new employment opportunities by providing vocational training	
	d. Agricultural land	
	e. Established new vending zones	
	f. Not received any compensation	
	g. Others(specify)	

5.4. Land holding Particulars

Control over any land	Type	Land in Acres	
		Pre- Mining	Post- Mining
(a) Leased in	1. Yes		
	2. No		
(b) Leased out	1. Yes		
	2. No		

5.8. Could you please explain the main source of your livelihood generation?
(a)Agriculture [ ] (b) Mining [ ] (c) Both a & b [ ] (d) Other (specify): …….
5.9. Are you doing any other activities for subsidiary income? 1. Yes [ ] 2. No [ ]
5.10. If yes, state the reason.
(a) Main source is not sufficient enough [ ] (b) To give an addition to the main source [ ]
(c) Others (specify).....

Section: 6 Impacts on Agricultural Productivity

6.1 Are you engage in any type of agricultural production? 1. Yes [ ] 2. No [ ]
6.2 If yes, what are they?
.....
.....
6.3 Do you think that mining has any impact on agricultural production?
1. Yes [ ] 2. [ ]
6.4 If yes, please explain the types of problems you are facing due to mining,
.....
.....
6.5 Who made you aware about this trouble?
(a) Local leader [ ] (b) Other villagers [ ] (c) Friend [ ] (d) Others (specify).....
6.6 Have you ever notice any changes in agriculture due to pollution? 1. Yes [ ] 2. [ ]
6.7 Could you please explain the source of water for your farming?
(a) Rain water [ ] (b) Canal water [ ] (c) River water [ ] (d) Others (specify).....
6.8 Is the water sufficient for agriculture? 1. Yes [ ] 2. [ ]
6.9 Is pollution creates any barrier for agricultural production? 1. Yes [ ] 2. [ ]
6.10 Did you ever experience that pollution has reduced the fertile capacity of agricultural land? 1. Yes [ ] 2. [ ]
6.11. Do you think loss of some eco-friendly insects due to mining has brought a loss to fertility capacity of land? 1. Yes [ ] 2. No [ ]
6.12 If yes, can you site some examples?
.....
.....
6.14. Are you cultivating the entire land you possess? 1. Yes [ ] 2. No [ ]
6.15 If no why? .....

Section: 7 Impact of mining on cropping pattern

7.1 Changes in cropping pattern due to mining pollution

Sl. No.	**Name of the crop**	**Area cultivated (in acre)**		**Production (in Quintal)**		**Price per quintal**	
		Before	After	Before	After	Before	After
1.	Season 1 (Kharif)						
	Crop 1						
	Crop 2						
	Crop 3						
2.	Season 2 (Rabi)						
	Crop 1						
	Crop 2						
	Crop 3						

7.2 Costs of Cultivation (for Kharif)

Sl. No.	Items	Crop-1		Crop-2		Crop-3	
		Before	After	Before	After	Before	After
1	Crop Name						
2	Seed own (quantity) Kg						
3	Seed own Value (Rs)						
4.	Seed purchased : Kg						
5.	Seed purchased (value) Rs/ kg						
6.	Fertilizers purchased: Kg						
7.	Fertilizers purchased (value) Rs/ kg						
8.	Pesticides purchased: (value) Rs/ litre						
9.	Tractor (Own/ Hired)						
10.	Tractor (hours)						
11.	Tractor charges (Rs.)						
12.	Bullock (Own/ Hired)						
13.	Bullock (days)						
14.	Bullock (value) Rs.						
15.	Male family labour (days)						
16.	Female family labour (days)						
17.	Male hired labour (days)						
18.	Female hired labour (days)						
19.	Male wage rate (Rs)						
20.	Female wage rate (Rs)						
21.	Market location where crop sold						
22.	Transport cost of output from field to sale point (Rs)						
23.	Sources of Irrigation[2]						
24.	Expenditure on water						

7.3 Costs of Cultivation (for Rabi)

Sl. No.	Items	Crop-1		Crop-2		Crop-3	
		Before	After	Before	After	Before	After
1	Crop Name						
2	Seed own (quantity) Kg						
3	Seed own Value (Rs)						
4.	Seed purchased : Kg						
5.	Seed purchased (value) Rs/ kg						
6.	Fertilizers purchased: Kg						
7.	Fertilizers purchased (value) Rs/ kg						
8.	Pesticides purchased: (value) Rs/ litre						
9.	Tractor (Own/ Hired)						
10.	Tractor (hours)						
11.	Tractor charges (Rs.)						
12.	Bullock (Own/ Hired)						
13.	Bullock (days)						
14.	Bullock (value) Rs.						
15.	Male family labour (days)						
16.	Female family labour (days)						
17.	Male hired labour (days)						
18.	Female hired labour (days)						
19.	Male wage rate (Rs)						
20.	Female wage rate (Rs)						
21.	Market location where crop sold						
22.	Transport cost of output from field to sale point (Rs)						
23.	Sources of Irrigation[2]						
24.	Expenditure on water						

Section: 9 Mining & Environment

9.1Have you ever noticed any kind of pollution in your area? 1. Yes [ ] 2. No [ ]

9.2 If yes, please explain what are they? (a) Air pollution [ ] (b) Water pollution [ ]

(c) Noise pollution [ ] (d) Soil pollution [ ] (e) Others (specify).....

9.3 What causes pollution in your opinion?

(a)Use of toxic materials [ ](b) Use of heavy machines [ ] (c) Long period of extraction [ ]

(d) Clearing of vegetation [ ] (e) Other, specify.....

9.4 Have you ever notice any kind of noise pollution in your area? 1. Yes [ ] 2.No [ ]

9.5 Who bears the problem of noise pollution much?

(a)Women [ ] (b) Children [ ] (c) Elderly persons [ ] (d) Both women & children

(e) Women, children & elderly [ ] (f) Others, specify……

9.6 Can you please explain what kind of problem your family members are facing due to this?

.....

.....

9.7 Does blasting have any impact on your housing pattern? 1. Yes [ ] 2. No [ ]

9.8 If yes, have you ever drawn the attention of anyone in this regard? 1. Yes [ ] 2. No [ ]

9.9 Whom you consulted in this regard and what was their response?

.....
.....
9.10 Did you consulted with MCL authorities? 1. Yes [ ] 2. No [ ]
9.11 If yes, what was their response?
.....
.....
9.12 Do you feel mining pollution has some impact on local biodiversity? 1. Yes [ ] 2. No. [ ]

9.13 If yes explain how?

.....
.....
9.14 Do you feel the dust due to mining has reduced the productivity capacity of a tree?
1. Yes [ ] 2. No [ ]
9.15 If yes explain,
.....
.....
9.16 Is there any loss to local grazing land due to mining?1. Yes [ ] 2. No [ ]
9.17 Are you getting much fodder for your livestock? 1. Yes [ ] 2. No [ ]
9.18 Do you feel there is loss of vegetation in your area? 1. Yes [ ] 2. No [ ]
9.19 What are the MFP you used to collect from local forest earlier?
9.20 Are you getting the same MFP which you used to collect from forest earlier?
1. Yes [ ] 2. No [ ]
9.21 If no, what happen to all these products?
.....
.....
9.22 Explain about the loss of herbal medicines and its implication.
.....
.....
9.23 Do you have recognized any change in the case of flower trees in the context of time and season of flowering? 1. Yes [ ] 2.No [ ]
9.24 If yes can you explain?
.....
.....
9.25 Do you think that there is a loss to some animals which used to be seen in your local forest? 1. Yes [ ] 2.No [ ]
9.26 If yes explain about those animals,
.....
.....
9.27.16 State your view-in what way mining has disturbed the wildlife?
(a) Direct & Indirect mortality [ ] (b) Habitat loss / Alteration [ ] (c) Reduced habitat effectiveness [ ] (d) Increase human access [ ] (e) Blockage of movement [ ]
(f) Fragmentation of habitat [ ] (g) Hunting/poaching [ ] (h) Loss of vegetation
9.28 Explain what kind of loss has seen in your area due to deforestation?

Section: 10 Mining and Water pollution

10.1 Water Facility (Season wise)

Water type *(Put the codes)*	Sources of water*			Distance of source**			Number of sources***		
	S	W	R	S	W	R	S	W	R
Drinking									
Bathing/Washing									
Cattle/Livestock use									

Note: S: Summer, W: Winter, R: Rainy

**Own well-1/Community well-2/Own Tube well/Hand pump-3/Community Tube well/ Hand pump-4/Stream-5/River-6/Tank-Pond-7/Other (specify)-8*

*** Within house-1/Less than 100 meters-2/100-250 meters-3/250-500 meters-4/500 metres-1 Km-5/1 Km – 2 Km-6/2 Km – 5 Km-7/More than 5 Km-8*

**** Having 1-2 (1)/ 2-3 (2)/ 3-4 (3)/ 4-5 (4)/>5/<1.*

10.2 Have you ever noticed water scarcity for domestic use? 1. Yes [ ] 2. No [ ]
10.3 If yes, explain why?
.....
.....
10.4 Have you ever experienced water pollution in your locality? 1. Yes [ ] 2. No [ ]
10.5 If yes, when did you first experienced?
.....
.....
10.6 Can you please recall when it started first?
.....
.....
10.7 Are you putting bleaching powder in the well regularly? 1. Yes [ ] 2. No [ ]
10.8 If yes, how frequently...
(a) Once in a week [ ] (b) Twice in a week [ ] (c) Once in a month [ ]
(d) Twice in a month [ ] (e) Quarterly [ ] (f) Others, specify.....
10.9 What type of container do you use for keeping drinking water?
(a)Mud pot [ ] (b) Filter [ ] (c) Silver container [ ] (d) Aluminium Container [ ]
(e)Plastic Bottles [ ] (f) Others, specify.....
10.10 Are all members of your family taking bath every day? 1. Yes [ ] 2. No [ ]
10.11 Is MCL is providing safe drinking water to your community? 1. Yes [ ] 2. No [ ]
10.12 Are you availing the facility? 1. Yes [ ] 2. No [ ]
10.13What is the frequency of water in a day?
10.14 Are you satisfied with this? 1. Yes [ ] 2. No [ ]

Section: 11 Mining and Air pollution

11.1People's Perception Regarding the Cause Air Pollution

11.2 Have you ever noticed air pollution in your locality? 1. Yes [ ] 2. No [ ]
11.3 In your opinion what is the primary cause of air pollution?
(a) Transportation/loading/unloading [ ] (b) Blasting/drilling/sizing [ ]
(c) Burning of fossil fuel [ ] (d) Household Activity [ ]

Section: 12 (Mining and Health)

12.2 How will you describe your current health status?
(a) Excellent [ ] (b) Good [ ] (c) Fair [ ] (d) Poor [ ]
12.3 Do you think that pollution is the main cause of major health problems?
1. Yes [ ] 2. No [ ]
12.4 If yes, what the major health problems you are facing most of the time?
.....
.....
12.5 When did you first notice these health problems and their symptoms?
.....
.....
12.6 What is the frequency of these types of diseases? (a)Towering [ ] (b) Stumpy [ ]

12.7 Frequency and type of health problems

Sl. No.	**Type of health problems**	**Persons facing the problems**			**Frequency (Use the codes)**
		Pre-Minng	Post-Mining	Control Village	
1.	Skin disease				
2.	Gastro-intestinal disease				
3.	Malaria				
4.	Arthritis				
5.	Fever				
6.	TB				
7.	Asthma				
8.	Eye Allergy				
9.	Others (specify)				

Codes: Daily-1/ Monthly-2/Weekly-3/Yearly-4.

12.8 Are these problems old or new? (a) Old [ ] (b) New [ ]
12.9 Do you think that health problems are related to air/water quality? 1. Yes [ ] 2. No [ ]
12.10 If yes explain what are the major health problems occurring due to polluted water?
12.11 Which section in your opinion is the more victimized due to mining?
(a) Men [ ] (b) Women [ ] (c) Children [ ] (d) Old-aged [ ] (e) Women & children [ ]
(f) Women, children & old-aged [ ] (g) Others (specify).....
12.12 If so, give reasons for it..
.....
.....
.....

12.13 Health effects

Sl. No.	No. of people affected	How long did the symptom last (days)	No. of days unwell	Did MCL beard any expenses	If yes, what is the cost	
				(Yes/No)	Male	Female
1.						
2.						
3.						
4.						
5.						
6.						

12.14 Health Cost

Sl. No.	Travel expenses	Dietary expenses	Medical Expenses				No. of working days lost	Frequency of visit to doctor	Income lost due to this
			Doctor's fee	Medicine	Lab tests	Cabin charge			
1.									
2.									
3.									
4.									
5.									
6.									

12.15 Is there any primary health centre in your village? 1. Yes [ ] 2. No [ ]

12.16 If yes how far is it from your residence? ……..

12.17Is MCL is doing anything to address the health needs of the community?

1. Yes [ ] 2. No [ ]

12.18 If yes mention some of these activities?

12.19 Has MCL built any health care institution for the service of both workers and people in the community? 1. Yes [ ] 2. No [ ]

12.20 If yes are you visiting this health centre at the time of requirement?

1. Yes [ ] 2.No [ ]

12.21 If no, mention the reason,

.....

.....

12.22 Does MCL have given health insurance to all your family members?

1. Yes [ ] 2.No [ ]

12.23 Are you happy with the service provided by that health centre? 1. Yes [ ] 2.No [ ]

12.24 Does MCL carry out any health campaign programme to educate people in the community?

1. Yes [ ] 2.No [ ]

12.25 If yes, give any example of such activities you know of

.....

.....

12.26How often are such campaigns carried out? (a) Weekly [ ] (b) Monthly [ ]

(c) Quarterly [ ] (d) Bi-annually [ ] (e) Yearly [ ] (f) Others (specify).....

12.27 Does MCL have done something to take care of hygienic condition of your village?

1. Yes [ ] 2.No [ ]

12.28 If yes, mention those,.....

Section: 13 (Impact on Livestock)

13.1. What types of problems livestock are facing? (a) Diseases [ ] (b) Weakness [ ]

(c) Decline in productivity [ ] (d) Decline in quality and quantity of manure [ ]

(e) Death [ ] (f) Others (specify).....

13.2. When did you first notice the problems first and in what form?

13.3. How did it start? (a) Grazing contaminated grass [ ] (b) Drinking polluted water [ ]

(c) Any other (specify).....

13.4. How much you are spending on their health?

.....

.....

13.5. Are there any cattle diseases found during past years? 1. Yes [ ] 2.No [ ]

13.6. Do you think that the livestock health is linked with water quality? 1. Yes [ ] 2.No [ ]

13.7. Ownership of Livestock

Livestock	No.	Assets	No.
Cow		Goat	
Buffalo		Sheep	
Ox		Poultry birds	
Others (Specify)		Others (Specify)	

Section 14: Mining and Social Structure

14.1. What type of family do you have?

(a) Joint family [ ] (b) Nuclear family [ ] (c) Extended family [ ] (d) Others (specify).....

14.2. Can you remember what type of family system do your forefathers had?

(a) Joint family [ ] (b) Nuclear family [ ] (c) Extended family [ ] (d) Others (specify).....

14.3. Could you please explain why are you moving towards this type of family system, if any?

.....

.....

14.4. What kind of family do you prefer? Mention the reason...

.....

.....

14.5. Where your other lineages are living at present?

(a)Nearby village [ ] (b) Same village [ ] (c) Don't know [ ] (d) Others (specify).....

14.6. Are you continuing the relation with your family members who are not staying with you? (a)Yes [ ] (b) No [ ]

14.7. If yes, mention the method through which maintaining the relation.

.....

.....

14.8. If no, mention the reason.

.....

.....

14.9. What kind of dealings do you have with your neighbour?

(a) Formal [ ] (b) Informal [ ] (c) Don't know [ ] (d) Others (specify).....

14.10. What form of marriage do you prefer?

(a)Arrange Marriage [ ] (b) Love Marriage [ ] (c) Others (specify)....

14.11. How could you explain marriage?

(a)A social bond [ ] (b) A religious sacrament [ ] (c) A social security [ ]
(d)An imposition [ ] (e) others (specify).....

14.12. Does anybody in your house did love marriage? (a) Yes [ ] (b) No [ ]

14.13. If yes, was there any controversy held during that time?(a) Yes [ ] (b) No [ ]

14.14. If yes, how did you handle this situation?

.....

.....

14.15. If no, why?

.....

.....

14.16. Whom do you marry? (a) Unknown person [ ] (b) Known person [ ]
(c) Relative [ ]

14.17. If the case of relatives' marriage found, is it the tradition?

(a) Yes [ ] (b) No [ ]

14.18**.** If no, why you prefer now days?

.....

.....

14.19. Marriage System

Category	Pre Mining	Post mining
Age at marriage~		
Decision making*		
Caste endogamy#		
Clan Exogamy@		
Distance of marriage+		
Dowry system^		

Codes Used:

~ Below 18(1), Below 25 (2), Above 30 (3), More than 30 (4)

**Common (1), Collective (2), Individual (3)*

#Within Caste (1), Inter caste (2), No such restriction (3)

@Outside the clan (1), within the clan (2), No such restriction (3)

+Same village (1), Nearby village (2), Within the block (3), Within the district (4), No such restriction (5)

^High dowry system (1), Left to the bride's home (2), No dowry system (3)

14.20. What are the festivals do you observed at your village level before mining?

.....

.....

14.21. Are you continuing the same in present days? (a) Yes [ ] (b) No [ ]

14.22. If no, mention the reason?

.....

.....

14.23. If yes, are you celebrating with same spirit? (a) Yes [ ] (b) No [ ]

14.24. If no mention the reasons.

.....

.....

14.25. What are festivals do you observe at the household level?

.....

.....

14.26. Is there any change in celebrating those festivals in now days?

(a) Yes [ ] (b) No [ ]

14.27. If yes, explain

.....

.....

15. Impact on Social Life

15.1. How do you spend your leisure time?

……

……

15.2. What you used to do before mining?

……

……

16. Impact on Economic Stability

16.1. Do you have any idea regarding Jajmani System? (a) Yes [ ] (b) No [ ]

16.2. Do you practise it now-a-days? (a) Yes [ ] (b) No [ ]

16.3. Do your forefathers practise it ? (a) Yes [ ] (b) No [ ]
16.4. Reason behind the non-practice of Jajmani System?
(a) Expansion of market economy [ ] (b) Absence of Land [ ]
(c) Mechanisation of agriculture [ ] (d) Introduction of contractual labour system [ ]
17. Impact on Old Age Population (Only for Old-aged)
17.1. What kind of dealing do you have with your children?
……
……
17.2. Are you living with them at present? (a) Yes [ ] (b) No [ ]
17.3. If No, why?
.....
.....
17.4. Are your children taking care of your health and daily needs? (a) Yes [ ] (b) No [ ]
17.5. What do you do to sustain your livelihood?
……
……

NATIONAL INSTITUTE OF TECHNOLOGY
Rourkela, Odisha – 769008

SOCIO-ECONOMIC IMPACT OF MINING ON RURAL COMMUNITIES: A CASE STUDY OF THE IB VALLEY COALFIELD IN ODISHA

(Village Schedule)

1. General Information

1.1. Name of the Village: ……..
1.2. Gram Panchayat: ……
1.3. Block: …….
1.4. Sub-Division: …….
1.5. Tehsil: …….
1.6. District: ……..

2. Location

Sl. No.	Particulars	Distance	Si. No.	Particulars	Distance
2.1	G.P. HQ		2.10	Electric Sub-station	
2.2	Block HQ		2.11	Anganwadi Centre	
2.3	District HQ		2.12	Primary School	
2.4	PHC HQ		2.13	Middle School	
2.5	Nearest Bank		2.14	High School	
2.6	Post Office		2.15	College	
2.7	Bust Stop		2.16	Health Centre	
2.8	Daily Market		2.17	Police Station	
2.9	Weekly Market		2.18	Railway Station	

3. Demographic Data

Hamlet	Hindu	Muslim	Christian	Others	Total	SC	ST	OBC	General	Total	Male	Female	Total
Total													

4. Village Level Infrastructural Information

Sl. No.	Infrastructure	Infrastructure exists (Yes/No)	If yes (Quantity)	Impact	
				Pre-mining	Post-mining
1.	Panchayat office				
2.	Anganwadi				
3.	Primary school				
4.	Middle school				
5.	High school				
6.	PHC				
7.	MHC				
8.	All weather road				
9.	Post office				
10.	Hand Pump				
11.	Sanitary Dug well				
12.	Bore well				
13.	Pond				
14.	River				
15.	Nala				
16.	ICDS Centre				
17.	Grain House				
18.	Youth Club				
19.	Public telephone (PCO)				
20.	Cooperative Society				
21.	Bank				
22.	Temple of village deities				
23.	Burial Place				
24.	Pasture land				
25.	Play ground for children				
26.	Police station				
27.	Others(specify)				

5. Access to Common Property Resources

Sl. No.	CPR	Resources Availability(Yes/No)		Accessibility*	
		Pre- mining	Post-mining	Pre- mining	Post-mining
1.	Village pond				
2.	Common well				
3.	Tube well				
4.	Water tape				
5.	River				
6.	Water stream				
7.	Cremation ground				
8.	Grazing ground				
9.	Reserve forest				
10.	Threshing ground				
11.	Temple/Mosque/Church				

12.	Open air shrines				
13.	Holy grooves				
14.	Bhagbat Tungi				
15.	Community centre				
16.	Others(specify)				

6. Land Availability beside Agricultural Land

Sl. No.	Land in Acre	Pre- mining		Post- mining	
		Yes/No	Area (in acre)	Yes/No	Area (in acre)
1.	Grazing Land				
2.	Cremation ground/Burial ground				
3.	Fallow Land				
4.	Community Forest				
5.	Common Field				
6.	Play Ground				
7.	Threshing grounds				
8.	Any Others (Specify				

7. SocialCapital&Associations

Sl. No.	Groups	Pre- mining			Post- mining		
		Yes/No	Number	Activities (Yes/No)	Yes/No	Number	Activities (Yes/No)
1.	Women'sGroup (Mahila Mandal)						
2.	FarmersGroup(PalliShrotaMandali)						
3.	YouthClub						
4.	SelfHelp Group						
5.	Milk cooperatives						
6.	CulturalGroup						
7.	Caste/TribePanchayat						
8.	Anyother (Specify)						

8. Land Holding

Sl. No.	Land Holding Category	Land Holding (Patta land in acre)									
		Pre- mining					Post- mining				
		SC	ST	OBC	GEN	Total	SC	ST	OBC	GEN	Total
1.	Land less										
2.	Marginal (up to 2.5 Acre)										
3.	Small (2.5-5 Acre)										
4.	Medium (5-10 Acre)										
5.	Large (Above 10										

	Acres)										
6.	Total										

9.1. Has mining affected anyway to the functioning of these groups? A. Yes [ ] B. No [ ]
9.2. If yes, please state the reasons,
……
……
……
9.3. Is there any type of pollution? A. Yes [ ] B. No [ ]
9.4. If yes, what are they?
9.5. When did it start?
9.6. What are the major problems associated with water pollution?
……
……
……
9.7. What are the major problems associated with air pollution?
……
……
……
9.8. What are the major problems associated with noise pollution?
……
……
……
9.9. Is MCL is doing any awareness campaign for the affected community?
A. Yes [ ] B. No [ ]
9.10 What kind of activity govt. is doing?
……
……
……
9.11 Is there any NGO working in this issue? A. Yes [ ] B. No [ ]
9.12 If yes, what are their perspectives?
……
……
……...

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(Questionnaire for authorities)

1. Name of the respondent: .....
2. Sex A. Male [ ] B. Female [ ]
3. Age of the respondent: .....
4. Department/ Position of the respondent:.....
5. Work period of the respondent: .....
6. Is there any CSR unit within MCL? A. Yes [ ] B. No [ ]
7. If yes, since when?

.....

8. Is social responsibility activities incorporate into your organization's policy?
A. Yes [ ] B. No [ ]
9. What kind of works CSR unit does?
A. Arts & entertainment [ ] B. Safety & public health [ ] C. Social speculation [ ]
D. Others (specify).....
10. What percentage of your company's pre-tax profits is spent on (CSR) projects?

……

……

11. Are you committed in providing rehabilitation packages to the displaced households? A. Yes [ ] B. No [ ]
12. Can you please explain how many households have been displaced with the establishment of mining projects of MCL in the IB valley area?

…….....

.....

13. Did MCL provided proper rehabilitation package to all the displaced families?
A. Yes [ ] B. No [ ]
14. If yes, explain the process,

……

……

15. Have you come across any protest regarding displacement by the local people?
A. Yes [ ] B. No. [ ]
16. If yes, how did you resolve the problem?

.....

.....

.....

17.Did MCL provided all the basic amenities to all the displaced persons?
A. Yes [ ] B. No [ ]

18. Have you taken any steps to avoid natural disasters in your project site?
A. Yes [ ] B. No [ ]
19. Does MCL conduct any health campaign for the workers and mining communities? A. Yes [ ] B. No [ ]

20. If yes how often? A. Weekly [ ] B. Monthly [ ] C. Quarterly [ ]
D. Bi-annually [ ] E. Yearly [ ] F. other, specify.....
21. What type of patients usually attended the campaign?
A. Asthma [ ] B. Skin disease [ ] C. Respiratory disorder [ ]

D. Malaria [ ] E. Fever [ ] F. Other, specify.....

22. What is the frequency of asthma patients in every campaign?

A. 1-5 [ ] B. 5-10 [ ] C. 10-15 [ ] D. 15-20 [ ]

E. Others specify.....

23. What is the rate of recurrence of patients having skin diseases in every campaign?
A. 1-5 [ ] B. 5-10 [ ] C. 10-15 [ ] D. 15-20 [ ]
E. Others specify.....
24. Do you think mining is the main reason behind the occurrence of these types of problems?
A. Yes [ ] B. No [ ]
25. What steps you have taken in controlling the movement of vehicles and machineryin order to minimize environmental damage?

……
……
……
26.Have you done a separate road/track for the movement of your vehicle?
A. Yes [ ] B. No [ ]
27. Are you doing any blasting on your mining site?
A. Yes [ ] B. No [ ] C. Unsure [ ]
28. If "yes", explain how you are minimizing the environmental impacts, including the safety of humans, livestock and wildlife?

……
……
……

29. What are the mitigation measures taken to protect from environmental effect due to mining? (Attach if any printed things available)

.....
.....

30. Where are you getting water for your mining operation?
A.Tank [ ] B. River [ ] C. Own borehole [ ] D. Any other source,
31. Where are you disposing your waste water every day?

……
……

32. What are the methods you have adopted in minimizing and avoiding polluting any water source, including underground water?

.....
.....
.....

33. Have your organization has taken any steps in providing safety water for drinking and domestic use? A. Yes [ ] B. No [ ]

34. What are the steps you have taken in providing safety drinking water to the mining affected villagers?

.....
.....
.....

35. Do you feel that your activities have brought an unnecessary damage to plants and wildlifein or near your mining claim) e.g. accident, hunting, plant collecting, fishing, etc.) ?
A. Yes [ ] B. No [ ]

36. What are the steps your organization has taken in protecting those?

.....
.....
.....37.What steps MCL has taken to restore the ecological resilience in mining areas?

.....
.....
.....

38. Can you please explain what amount of forest land has been acquired in the IB valley area for mining purpose?

.....
.....

39. Can you please explain what amount of agricultural land has been acquired in the IB valley area for mining purpose?

.....
.....

40. Have you submitted the CAMPA fund to the Govt.? A. Yes [ ] B. No [ ]

39. Do you feel the Govt. has properly utilized the CAMPA fund which MCL submitted? A.Yes [ ] B. No [ ]

41. If yes, state how?

……
……
……

42. If no, give your comments and suggestions

……
……
……
……
……

BIO-DATA

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